RAILROAD GAZETTE

FRIDAY, AUGUST 31.

CONTENTS.

Contributions.

Property in Inventions.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I wish you would kindly answer the following questions through the columns of your paper: Is the invention of a subordinate the property of his superior? And, further, if the subordinate invents apparatus which is patented by the superior without the subordinate's knowledge, is there any redress possible through the courts? A SUBSCRIBER.

[The invention of a subordinate is not the property of his superior (*i. e.*, his employer), unless the inventor has been *employed for the purpose of aiding* his superior in *perfecting an invention*. The courts have uniformly held that an inventor has the right to call to his assistance any class of skilled aid and to realize the benefit of any improvements made by such skilled aid while in his employ.

The law provides that a patent shall be issued to the first inventor. Hence, if the subordinate was first to invent, and can prove the facts, the patent granted to his superior would be void, and a new patent would issue to the subordinate after interference proceedings duly had in the Patent Office.—EDITOR RAILROAD GAZETTE.]

The Abt System in the Bolan Pass.

EAST INDIA, July 27, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

By your issue of 8th June last, I see that you, among others, have been led astray by the misstatements made in certain of the Indian papers, anent the Rack Railway at the Bolan Pass.

There was, it is true, a slight hitch on the opening day, but this can in no way be attributed to any defect in the system, or any fault of the engineer in charge, Mr. Fritz A. Graf. I have never seen this gentleman, but know that he did excellent work at the Jubilee Bridge over the Hooghly and elsewhere, and as he is not at present in the country, I think it is only fair that you should know what really did occur. On the day in question Mr. Graf was persuaded, against his better judgment, I believe, to allow a number of officials, all anxious to see how the system worked, to accompany him on the trial trip, and in consequence, the foot plate was inconveniently crowded. The train started on the level, and consequently only the ordinary adhesion engine was working, and no one noticed that the rack engine machinery was in the back gear. When the rack rail was reached, the pinions were consequently working the wrong way, *i. e.*, they were working backward, while the adhesion system was working forward. This was noticed at once, and the engine stopped, and the only damage done was one of the rods slightly bent. This was put right, and the train started again and went the whole distance without further mishap. I give below the official report on the trial which speaks for itself:

The High Level Line of the Bolan Railway. Summary of experiments with Abt and Heavy "L" class engines.

Engines.	Vehicles. Loaded	Vehicles. Empty.	Actual weight. Tons.	Time in min. and secs.	Miles per hour.	Remarks.
1 Abt	8	2	158	7.30	8 +	Only 120 lbs. steam.
1 "	9	4	186¾	Not noted.		
2 "	9	4	186¾	6.30	9.23	Steam easy.
2 "	9	4	186¾	4.50	12.41	Steam easy, 130 to 140 lbs
2 "	9	13	269	10.00	6.00	Steamed well 120 to 140 lbs.
2 "	9	14	304	10.00	6.00	
2 Heavy L.	9	4	186¾	6.00	10.00	Steam kept well, 140 to 160 lbs., but if stopped could not have started again.
2 " "	10	6	221¼	6.35	9.10	
2 " "	11	8	259¼	9.10	6.55	
1 Abt	11	8	259¼	15.00	4.00	

It should be pointed out that the L class engines entered the rising gradient with a speed of at least 15 miles per hour, having started some distance back on a descending gradient, which gave them a considerable advantage over the Abt engines, which only entered the rising gradient with a speed of 4 to 5 miles per hour. Moreover, it would be impossible, with a maximum load, for an L engine to *stop* and *start again* on the *upward* journey, *as was achieved by the Abt engine*.

These experiments made on 30th March, 1888.

That the Abt engines will not work well on curves is simply nonsense, as on rack railways in Europe, curves of 590 ft. radius are worked without any trouble with these engines, and this is sharper in proportion to the gauge than any curves on Indian broad gauge lines. In fact, the long, rigid wheel base bogie frames on carriages and wagons being unknown, preclude the use of very sharp curves. Every one admits that the Fairlie system is a good one, but comparison between it and the Abt system is scarcely possible. Gradients that are easily overcome by the latter could not be worked by *any purely adhesion* system.

It must be remembered that the rack railroad, and its engines, are new to India, and, with the exception of Mr. Graf, no one knew anything about the system, and there are always little difficulties when introducing anything new on railroads. The line in question is now working well, and is not likely to be removed, as one Abt engine can do the work of two ordinary engines built for ghat working.

RAILROADER.

Wreck of the False Work of the Covington and Cincinnati Bridge.

COVINGTON, Ky., Aug. 27, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

A short account of the disaster the Phœnix Bridge Co. of Philadelphia met with yesterday, in loosing the false work and traveler for raising the channel span of the Ohio River bridge, will no doubt prove of interest.

The span is part of a structure which is over one mile in length, carrying double track railroad, two roadways and two sidewalks, the river being crossed by three spans, two 490 ft., and channel span 550 ft., being the longest simple truss ever made, and the heaviest per lineal foot. The Covington approach, some 1,500 ft. long, is finished, as is also the 490 ft. span on Kentucky side, the latter being erected in just one month, during which the very unusual rise of 33 ft. in July and heavy run of drift, were successfully combated.

The Phœnix Bridge Company, fully aware of the treacherous character of the Ohio River, designed false work of the heaviest description, everything being done in the most substantial manner. Double bents were placed under main panel points, 5 ft. apart, other bents being 16 ft. centres. False work was 60 ft. wide on top, 80 ft. wide at bottom, and 78 ft. high from pile cap to top cap. Under each bent were 12 piles, about 60 ft. long, driven 18 ft. into the bottom, with a 2,600-lb. hammer, falling 24 ft., moving only 1 in. or 2 in. at last blow. Piles were thoroughly braced within 18 ft. of bottom. False work bent consisted of five legs, 12 in. by 12 in. and four legs 12 in. by 12 in. Top, middle and bottom caps, two, 7 in. by 14 in.; bracing 4 in. by 12 in. transversely. Longitudinal bracing, 7 lines, 8 in. by 10 in. at each cap, and X bracing every fourth or fifth bent. On top were 22 lines of 8 in. by 16 in. stringers and 3-in. floor planks; on these rails for traveler.

At the time of the rise the false work was not quite finished, there being an opening of several bents near the Ohio pier. This part not being finished from pier to pier proved a source of weakness longitudinally. Provision had been made to guard against high water and drift, and at the first warning the cluster of 50 or 60 piles for a V-shaped bulkhead, 550 ft. up stream from the centre of span, was finished, thoroughly braced, and sheathed on outside with 3-in. planks. From this bulkhead lines of barges were run to each pier, and two lines of barges across this triangle on the inside to act as struts.

This plan acted very well until the water had risen 8 or 10 ft., and while the drift was comparatively light. On Friday, Aug. 24, the line of barges on the Kentucky side was bent in and drift began to collect toward its southern end. Lines were run from the point where this bending and accumulation of drift took place, to shore, and every effort made to hold the barges back, but without success. The heaviest manilla ropes were snapped in two, and wire cables also; and early Saturday morning the barges, under the tremendous pressure, broke loose, and, with the drift, settled back against the false work. Drift continued to accumulate, and finally filled the triangle included between the piers and the bulkhead, and still the false work bore the test, having only moved down stream, in a gentle curve, about 6 in., and toward the Ohio shore 3 in. Water had been rising steadily since Tuesday and heavy drift running since Wednesday, and for hours at a time bank-full. On Saturday the water had reached a stage of about 40 ft. at the bridge, and the current then seemed to change, carrying by far the greater accumulation of drift to the Kentucky side of the triangle. This produced a tremendous force longitudinally (the weakest direction, the false work not being complete) and the effect was soon seen in the bending of the piling and lower half of trestle, on the up-stream side, out of plumb and toward the Ohio side. Nothing could be done to stop this, and it continued until 10 o'clock, Sunday morning, Aug. 26, 1888, when the lower caps were broken near the centre, the piles gave way and the whole structure came down, settling down and leaning slightly up-stream. The drift began moving immediately and passed out with the wreck leaving clear water between piers in less than three minutes. This shows clearly that the drift had no support on the bottom, as we hoped, and speaks volumes for the strength of a false work which would sustain for two days such a tremendous pressure.

These two heavy rises in the summer within one month of each other were unprecedented; never before did a rise of any magnitude occur in July; and with each there was an unusual run of heavy drift, that in August being longer and heavier than ever noted by the oldest steamboat men. At least 450 miles of drift passed through during the four days and three nights. The wreck was landed by steamers along the shores below and, while very much broken, considerable will be saved. Measures have already been taken, and mills are already at work on timber piles; increased forces will be put on, and, by working day and night, it is hoped there will be no material delay in final completion of structure.

THE PHŒNIX BRIDGE COMPANY.

[The newspaper accounts state that with the wreck of the false works were included a traveler 104 ft. high, and a smaller traveler, used in erecting the false works, with three boilers and engines; about 350 ft. of the floor beams and stringers of the bridge, and 9 flat cars, three loaded with rails and six with piles, which had been run out on to the structure in the hope of giving it sufficient weight to withstand the flood. This bridge is building by the Phœnix Bridge Co for the Cincinnati & Covington Elevated Railway Bridge Co., and is to carry the Chesapeake & Ohio into Cincinnati. —EDITOR.]

The Chair of Engineering Practice, Stevens Institute.

LITCHFIELD, Conn., Aug. 21, 1888.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In reply to your request for some account of the course of instruction to be followed out in the new department of engineering practice at the Stevens Institute of Technology, I would say in the first place that this can be best made clear by pointing out the nature of the problem which was presented to the organizers of the Stevens Institute and the character of the solution worked out.

President Morton, who twenty years ago was called upon to attempt this solution, had many consultations on the subject with the present writer, and the problem developed itself into the following shape: The product sought for was a practically useful mechanical engineer, or a young man who could go into the drawing room and workshop, and in a reasonably short time make himself useful by his ability to apply the principles of mathematics and science generally to the designing and construction of machinery. In order that this result should be realized, it was of the first importance that the student should be grounded in *practical applications* of the sciences to the work in hand, and not misled into such exclusive devotion to abstract principles and theoretical methods as would throw him out of sympathy with practical work, and render him useless and a failure in the business of his life. I well remember the case of an educated draughtsman taught in some of the best schools of Europe, who died a disappointed and unsuccessful man from finding no employment in the shops of practical mechanics. He was set in his ways, and these bad ways as regards their practical applications. He regarded his knowledge as invaluable, and perhaps it was so far as it went, or if judiciously applied; but as he used it it was valueless or worse than valueless to himself and others, who could find no use for him or his impracticable methods.

Such as I have indicated being the desired product, the next question was to find the machinery necessary for its production. No school of the sort proposed existed in this country, nor, in the exact form required, in any country, and there was therefore neither a model nor a reservoir from which material could be drawn. Professional instructors of a high grade were attainable, but as a rule they had little or no familiarity with the needs of the practical mechanical engineer, and their knowledge of mathematics, drawing, physics, chemistry, etc., however profound, as a rule dealt with a class of problems which differed so much in detail from those encountered by the mechanical engineer that, though the underlying principles might be all that was necessary, their mode of application to the practical problems of the machine shop was too little developed to be useful.

For example, the mathematicians were fond of discussing equations which were at once capable of application to the motions of the planets of a solar system and of the connecting-rod of a steam engine; but they had only developed them in the former direction, and the transformations needed to reduce them to a shape useful for the latter purpose were by no means easy. Even when practical problems were approached by the mathematicians, it was considered rather undignified to make them too practical, and broad generalizations were preferred to direct every-day examples. An incident within the experience of the writer will illustrate this. In 1865 the *Journal of the Franklin Institute* was placed in the hands of Prof. Morton as editor, the writer being at that time one of the committee of publication. Among articles on hand awaiting publication were some of a highly mathematical character from the pen of Prof. De. Volson Wood, then of the University of Michigan. These were considered by the committee and editor as too little interesting to mechanics at large to be appropriate to the new character which it was proposed to give to the *Journal*. Prof Morton was, therefore, desired to write to Prof. Wood explaining the situation, and asking him to contribute something of a more popular character. In reply, Prof. Wood, taking the re-

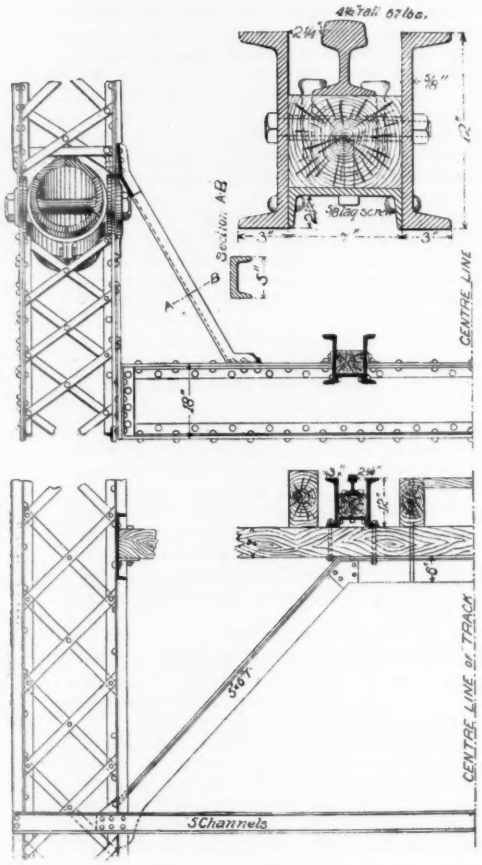


Fig. 1.

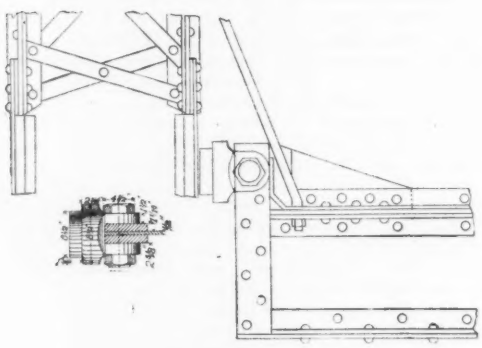


Fig. 3

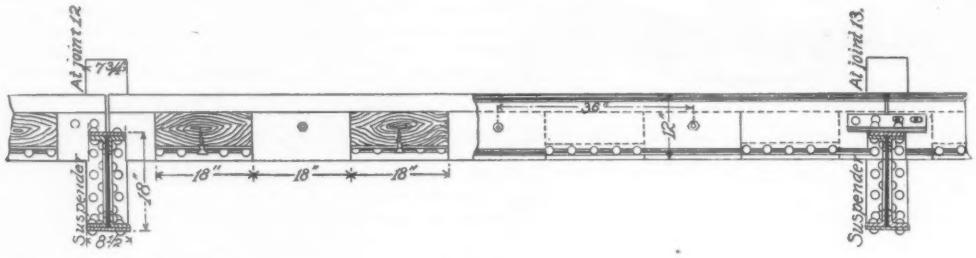


Fig. 2.

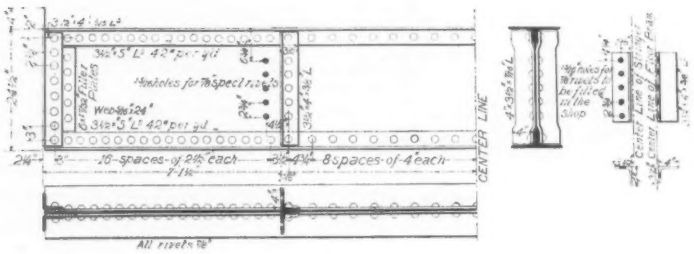
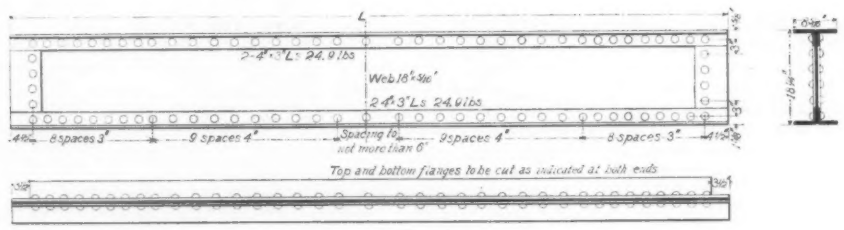


Fig. 4.



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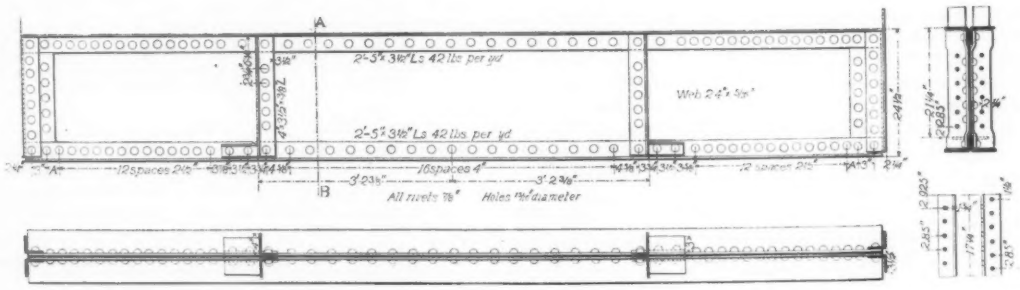


Fig. 6.

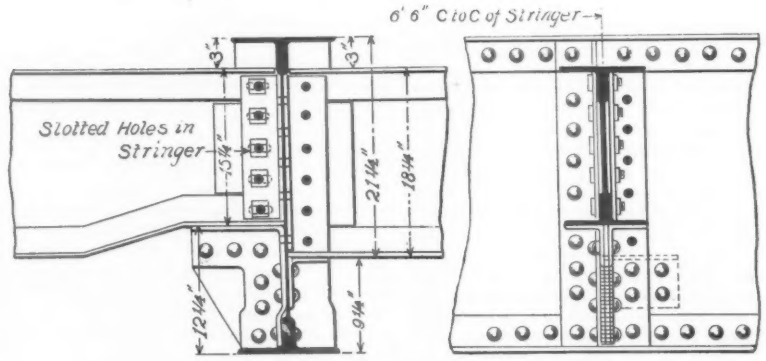


Fig. 7.

RECONSTRUCTION OF THE RAILROAD FLOOR OF THE ST. LOUIS BRIDGE.

quest in good part, said that he had himself been for some time surprised that the *Journal* was willing to accept and publish articles of so purely a theoretical character as he had been writing, but as long as they were willing, he, as a mathematician, was well pleased to work on that line. Now, however, he would cheerfully modify his treatment. In fact, he then inclosed a most valuable practical discussion of the action of "jam-nuts," which was followed by many more contributions of like character. This incident well illustrates the tendency on the part of the educated professional instructor to direct his energies along the line of the general and unpractical rather than on that of the concrete and useful. And it naturally followed that young men taught under this system, if they came into the workshop, would be distinguished more by their ignorance of the concrete methods there called for than by their knowledge, however profound of the generalities which were not required and which they did not know how to reduce to some useful shape.

In the next place there were "in sight" many experienced mechanics capable of successfully designing and executing the most difficult work. The ablest of these were, however, of course, unattainable for employment as instructors, and the large majority, including even those who had achieved wealth by their successful work, were but little conversant with the mathematical and other scientific methods by which work can be abbreviated and failure prevented, and even prejudiced against the use of such methods. To illustrate this prejudice, a recent communication to a leading mechanical paper tells of a draughtsman who had lost his place because he had undertaken to calculate the strength of an important part of a machine. The tone of the paper would lead one to suppose that such method was not correct, and that the proper course would be to measure the corresponding parts of similar machines by other makers, and to copy these proportions with an increase in weight. Again, the owner of a large machine shop once applied to me for a spur-wheel. He had marked the diameter on a wooden rod. Asking him if the mark indicated outside diameter or diameter of pitch-line, he replied in his brusque way, "Pitch line! What in h——l is pitch line? I want a wheel as big as this stick, with eighty teeth in it."

From the material available, it was considered best to secure at the outset the highly educated professional instructors who had the greatest leaning towards mechanical work, and in this, as the event proved, the effort was wonderfully successful. Thus, in the original Faculty of Stevens Institute of Technology were found Prof. R. H. Thurston (the son of a practical mechanical engineer), who had passed his boyhood in the machine shops of his father's works, and had afterwards passed through a college course, acted as engineer in the navy during the war, and as professor at the naval academy; Prof. De. V. Wood, educated at the Rensselaer Polytechnic Institute, and having a special natural bent for practical mechanics, as illustrated by his inventions and constructions of steam rock-drills, not to mention his practical contributions to the *Journal of the Franklin Institute*, to which reference has been made already; Prof. C. W. MacCord, a graduate of Princeton, of long experience as a draughtsman, and to whose ability and promptness in meeting and overcoming unexpected contingencies it was due that the "Monitor" was at Hampton Roads on the 9th of March, 1862, and not in the Brooklyn Navy Yard; Prof. A. M. Mayer, who had studied abroad in the famous institutions of Paris, and whose manual dexterity as a fine workman had been displayed in numerous instruments constructed by himself while occupying the chairs of physics at the Gettysburgh and at the Lehigh universities.

With these men thus equipped in the direction of practical mechanics to represent the specially mechanical parts of the course, the Stevens Institute of Technology was started on its career. As years rolled on, additions were made to its faculty from its own alumni, who had in the interim obtained more or less practical experience in the workshops of the country, in addition to that obtained in the workshops of the Institute; but President Morton has always had in view the object of securing instruction such as could only be given by one who had acquired, by long experience in the actual management of great machine works, the intimate knowledge of details in the successful arrangement and selection of tools and materials, the order and method of construction, and the management of men as well as of matter, that invaluable knowledge which can be accumulated in no other way.

The chair of engineering practice is founded with the view of bringing the customs and usages of the shop to the knowledge of the student at a time when his previous training in general principles, and acquaintance with the actual operations of tools from their use in the Institute workshops, have prepared him to understand and appreciate the instruction given. Rules and regulations governing the methods of work —governing the processes of designing—governing the selection of materials—governing the selection of tools and methods—governing the mercantile relations of the subject, and governing the management of men, will all be naturally developed in the work of this department. The young engineer must know that he may be called upon to manage establishments where many of the workmen are very superior

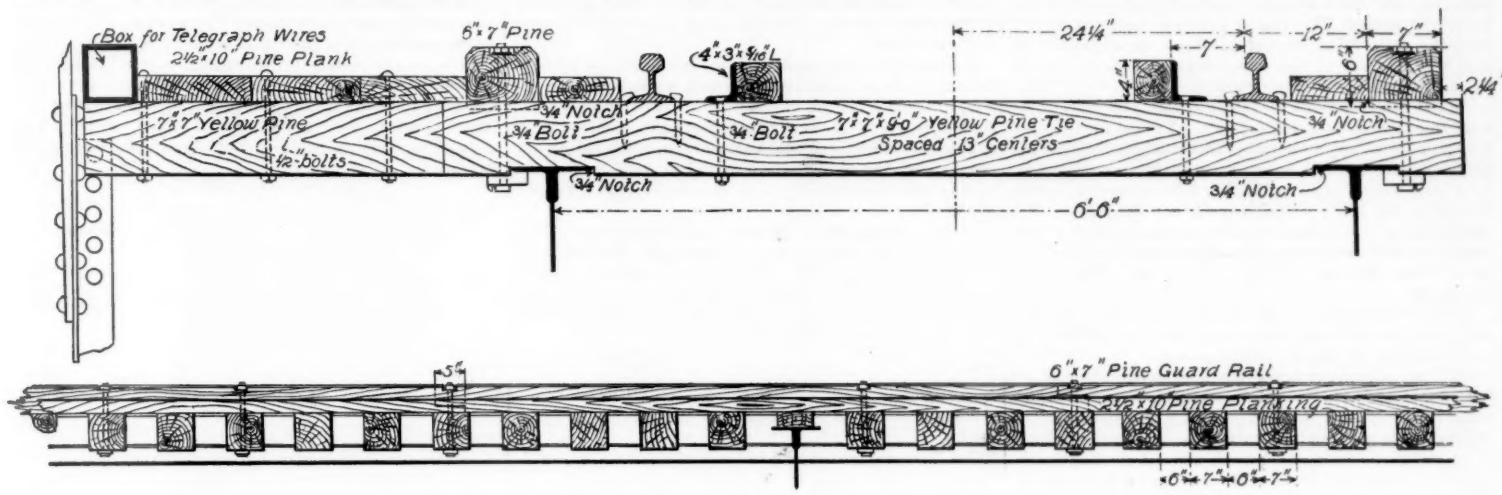


Fig. 8.

to him in skill and in experience, and even in mental faculties.

It will be his place to direct these men without antagonizing them, to make them feel that his training has fitted him to help them in just what they lack. All this the graduate can the more readily do if he comes into the shop with some information in what may be called the manners and customs, the language and history, of that new country, in addition to his valuable possessions in the way of mathematical and other scientific methods for facilitating the work and securing accuracy in designing, which the technical school has given him.

COLEMAN SELLERS, E. D.,
Prof. Engineering Practice, Stevens Institute of Technology.

The Reconstruction of the Railroad Floor of the St. Louis Bridge.

BY N. W. EAYRS, C. E., *Assistant Sup't of Structure and Interlocking.*

The reconstruction of the lower roadway, or railroad floor of the St. Louis bridge, is upon a design so radically different from that of the present floor, that a brief description of the latter, and of its relation to the other parts of the bridge, may not be out of place. The bridge, as is well known, consists of three arched spans which carry two roadways; the upper roadway containing the highway and the lower the railroad tracks. The two side spans are 502 ft. each, and the centre span is 520 ft. in the clear. Each arch is composed of four equal ribs, each consisting of two circular members, an upper and a lower, braced together by a single system of diagonal bracing. The two members are 12 ft. apart, centre to centre. The ribs are constructed of straight steel tubes 12 ft. long, the ends of the tubes in each member butting together and joined by steel couplings. Through the coupling at each joint passes a steel pin, which furnishes the connection for the diagonal bracing between the upper and lower members of each rib, and for the lateral bracing between the four ribs. The two roadways are carried upon the upper member of each rib, the upper roadway resting upon the tops of latticed posts which rest upon the steel pins above mentioned; the lower roadway is supported on the pins by posts or hangers, according as the roadway is above or below the upper member.

The railroad tracks, which are carried between the two outer pairs of ribs, leave the abutments at approximately the same elevation and rise with a grade of 1.5 per cent. to the middle of the side spans. Between these latter points the grade of the tracks is a parabolic arc. The position of the track floor, with reference to the arch, is such that at the middle of each span the floor beams are on a level with the lower member of each rib. Between the points in each span where the upper member begins to rise above the track floor the direct lateral bracing between the ribs is necessarily omitted (see fig. 1). Within this space the upper tubes of the outside ribs are braced to those of the inner pair of ribs either by a sort of trapezoidal truss carried overhead or by channel bars riveted to the posts and to the tops of the floor beams.

That portion of the lower roadway which is above the ribs is supported at each panel point by a peculiar form of construction known as "knee-braces." (See fig. 1.) These knee-braces are formed of T-iron, 6-in. stem and 5-in. base, bent to form three sides of a trapezoid. Reinforcing plates of ½-in. iron are riveted to the stem of the T at the angles. The ends of the knee-brace are riveted to the post with 8 ¾-in. rivets, and the posts are stiffened to resist the thrust of the knee-brace by a pair of 5-in. channels extending the whole width of the bridge, which act as tie-bars under the tracks, and as struts between the inner pair of ribs. On top of the knee-brace is bolted an oak stick 7 × 7 in., the ends resting on angle-iron lugs riveted to the posts. The track stringers rest upon these sticks, and are bolted to them with ¾-in. bolts.

The remaining portion of the floor is supported by plate-girder floor beams, either riveted to the posts, or suspended from the steel coupling pins by suspended bars or hangers. The connection of the floor beams with the arches, at the points where the roadway intersects the upper member of the rib is made by a peculiar construction called a "jaw-nut."

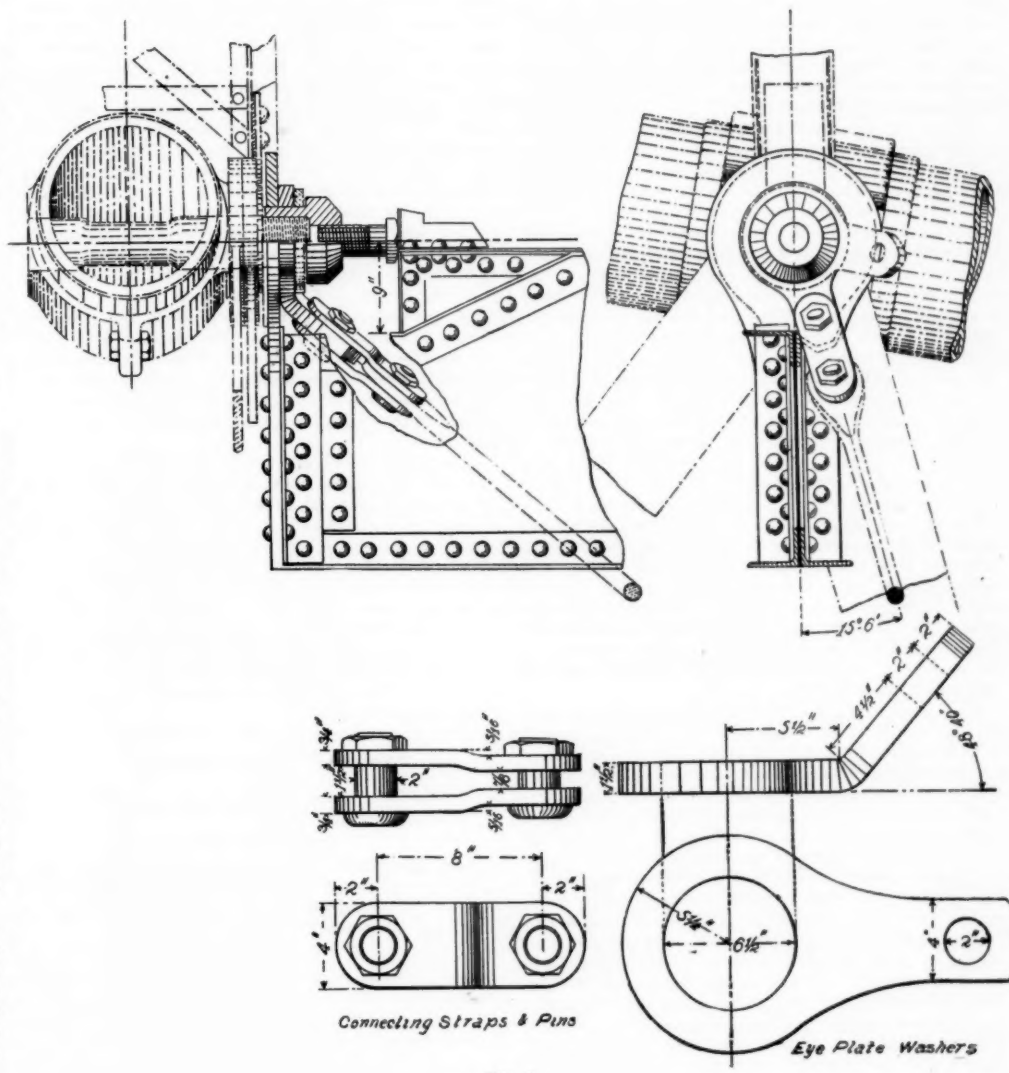


Fig. 9.

RECONSTRUCTION OF THE RAILROAD FLOOR OF THE ST. LOUIS BRIDGE.

The jaw-nut is screwed on to the end of the steel coupling pin; the end of the floor beam is then slipped in between the jaws, and held in position by a steel pin 3 in. in diameter, which passes through the two jaws and the end of the beam. At these joints the floor beams act as struts between the ribs, and take the place of the "tube-stays."

The floor beams are of iron and of the usual type of plate girders, 14 ft. 3 in. long, 18 in. deep. The web plate is ½ in., top angles 3¼ in. × 2 9/16 in. × 9/16, bottom angles 4 in. × 3 in. × 9/16 in., with top and bottom plates of ¾ in. thickness. The rivets are 1 in. diameter, spaced 9 in. apart. The floor beams are fastened to the suspenders with eight 1⅛ in. rivets at either end.

The track stringers of the present floor (see figs. 1 and 2) are 12-in. channels, weighing 53 lbs. per lineal ft., one pair of channels under each rail. The channels are placed back to back, and spaced 7 in. apart. Plates of 7 in. channel iron, 18 in. long, spaced 18 in. apart, are placed between the channel-bars of each stringer, and riveted to them with five ¾-in. rivets on each side. These plates serve as supports to oak blocks 17 in. long, 7 in. wide and 5¾ in. deep, on which the base of the rail rests. The blocks are fastened to the channel iron plates by two ⅝-in. lag screws screwed up into the block from below. Each track stringer thus forms a sort of trough in which the rail is laid; the top of the rail being ¾ of an inch above the top of the channel-bars. The rail is spiked to the oak blocks with ordinary railroad spikes.

Where the "knee-braces" are used, the bottom of the stringers rests upon the knee-brace tie, and is fastened to the knee-brace by ¾ in. bolts; where the stringers rest upon iron floor beams, the stringers are, with a few exceptions, notched down 5 in. over the floor beams. A 2½ × 2½ in. angle, one leg riveted to the adjacent ends of two stringers, the other leg riveted to the top of the floor beam, serves the double purpose of fishing the ends of the stringers together and retaining the stringers in their proper position with regard to the centre of track. The stringers are still further secured against lateral motion by three ⅞ in. bolts in each panel, which pass through the outside guard rail, the stringer and the adjacent side of the wooden frame which fills the space between the rails.

When the bridge was erected provision was made for the expansion of the track stringers by means of oblong holes in one end of the vertical leg of the 2½ in. × 2½ in. connecting angles above mentioned. One end of the stringer was fixed by riveting to the connecting angles, and the other end was simply bolted, the bolts passing through the oblong holes. Later, however, these bolts were removed and rivets substi-

tuted, and the track stringers now form a continuous line across the bridge. No trouble has ever been experienced with the track from lack of provision for expansion, although the crown of the centre arch rises nearly 9 in. between the extremes of temperature.

Outside guard timbers are used, dressed to $7\frac{1}{2} \times 11$ in. and placed 7 in. from outside of rail. The top of the guard timber is $1\frac{1}{2}$ in. above the rail. These timbers are bolted to each floor beam by hook bolts, and to the knee-brace ties by $\frac{3}{4}$-in. yoke bolts. In addition $\frac{7}{8}$-in. bolts connect these timbers with the track stringers as before described. The wooden frame which fills the space between the rails of each track is built of two longitudinal stringers of oak 5×12 in., one on either side, and joined by 3×8 in. oak plank, spaced 8 in. apart.

An outside walk, 3 ft. wide, between the outer rail and the side of the arch, and a wire rope hand rail complete the lower roadway floor, as it exists at present.

This form of stringer track has one strong point in its favor; it contains within itself a safeguard against injury to the bridge from a derailed car. On several occasions a derailed truck entering the bridge has been carried across on the flanges of the channel bars, and once a locomotive weighing 70,000 lbs. ran some distance on the stringers before it could be stopped. But it has some disadvantages to which it may be well to call attention. In the first place, it will be seen that the distance from the gauge side of the rail to the back of the 12-in. channels is but $2\frac{1}{4}$ inches. While this space is too narrow to allow a derailed wheel to drop down between the rail and the channel, it permits narrow tread wheels, or wheels too close together, to rub against the upper corner of the inside channel bars. This grinding action has gone so far that in some places the strength of the channels is considerably diminished.

Another objection which I will mention may apply only to this bridge, as it is due to the excessive "creeping" of the rails. On account of this motion of the rails (and also because of the narrow space between the channel bars which form each stringer) it is impracticable to use angle splices. The ends of the rails are fished together with the Samson bar. By the "creeping" referred to, the joints are constantly being pushed off the blocks, and at frequent intervals they become suspended joints with bearings 18 in. apart. Moreover, when the rail is tightly spiked, the blocks themselves sometimes go with the rail, the pressure being sufficient to either shear off the two $\frac{5}{8}$-in. lag screws by which the blocks are fastened to the plates or to pull them out of the oak blocks. Furthermore, the renewal of the oak blocks is a matter of no slight moment, for each block has to be dressed to exact size by template in order to preserve the surface of the track.

THE NEW FLOOR.

The moving load originally used in the computations for the bridge was estimated at $\frac{8}{10}$ of a ton, or 1,600 lbs. per lineal foot, *for each rib*, or 3,200 lbs. per lineal foot of *track*. In view of the great increase in the weight of rolling stock and capacity of cars since the bridge was built, and the heavy loading produced by spools of wire cable, weighing from 60,000 to 90,000 lbs., which frequently cross the bridge, it was decided, at the close of last year, to reconstruct the lower roadway, instead of renewing the channel stringers as originally intended.

The general design, upon which work is now going on, was furnished by Mr. Robert Moore, of St. Louis, Consulting Engineer of the St. Louis Bridge Co., some modifications and the details being worked out in the office of the Superintendent of Structure of the St. Louis Bridge & Tunnel Railroad. The new floor is proportioned for a moving load of 5,000 lbs. per lineal foot of track, with a concentrated load of 20,000 lbs. The material used is "mild" steel throughout, with an ultimate tensile strength of 64,000 lbs.; the test-bars to show (1) a tensile strength within 4,000 lbs. per sq. in. (either way) of that specified; (2) an elastic limit not less than one-half of the tensile strength of the test-bar; (3) a percentage of elongation not less than 1,200,000, divided by the tensile strength in pounds per square inch; and (4) a percentage of reduction in area not less than 2,400,000, divided by the tensile strength in pounds per square inch.

All of the old work will be removed, its place being supplied by floor beams and track stringers of the plate girder type, the general designs of which are shown in figs. 4 and 5. The new work will require 256 floor beams and 536 track stringers, 24 of the latter being steel I beams to be used in spanning the space between the end posts of each span and the abutments or piers. The estimated weight of material is, in round numbers, about 750,000 lbs. Steel rivets are to be used throughout, requiring about 40,000 lbs. for erection alone.

The general design for suspended floor beams is shown in fig. 6. The depth of the beams varies from $30\frac{1}{2}$ in. in those which take the place of the "kneebrace" beams, to $24\frac{1}{2}$ in. for the suspended beams, and in a few cases to $20\frac{1}{2}$ in., where a shallower beam to clear the lateral bracing of the lower tubes was more economical than to make a deeper beam and pass the rods through the webs. Wherever provision for expansion was contemplated the beams were made $30\frac{1}{2}$ in. in depth.

The general design for track stringers is shown in fig. 5. These are $18\frac{1}{4}$ in. deep; web, 18 in. $\times \frac{5}{16}$ in.; top and bottom angles, 4 in. $\times$ 3 in., 24.9 lbs. Some special forms are used, varying in depth from $12\frac{1}{4}$ in. to $22\frac{1}{4}$ in., where the conditions demanded them.

For the "jaw-nut" joints a special form of floor beam is used, shown in fig. 9. The old "jaw-nuts" are discarded and the floor beam is hung from the pins by suspenders. Outside the suspenders a cast-steel nut is screwed on to the pier. In the head of this nut is a steel set screw which is turned out until the head bears against the brace at the top of the beam. By this device the new floor beam is also made to act as a strut.

In addition to being fastened to the floor beams by connecting angles, the stringers rest upon steel angle brackets. At the expansion points (of which there are seven in each span) the brackets are made heavy enough to carry the load without the aid of the connecting angles. The expansion end of the stringer has slotted holes, 2 in. long, and is fastened to the connecting angles by $\frac{7}{8}$-in. steel bolts, turned to a fit. See fig. 7.

In dimensioning the floor beams and stringers the moment of inertia of the whole section, including the web, was used, except in those cases where the web-plates were cut to allow the lateral rods and tube-stays to pass through. In these, the top and bottom angles are made heavier, and the web omitted. The strains allowed were:

For gross section	10,600 lbs. per sq. in.
For net "	12,000 " "
For shearing	9,000 " "
For bearing	18,000 " "

For connections 50 per cent. was added to loads transmitted.

The ties used are of long leaf yellow pine 7 in. $\times$ 7 in. $\times$ 9 ft., carefully selected; every sixth tie is 12 ft. long, the extra length projecting on the outside of the track, in order to serve as a support to the footwalk. The ties are spaced 13 in. centres, as near as may be, and are notched down on the stringers $\frac{3}{4}$ of an inch. Every fourth tie is bolted to the stringer by a $\frac{3}{4}$-in. bolt with a clamp washer underneath, which catches the lower side of the top angle of stringer. (See fig. 8.) An outside guard-rail is placed on either side of the track 9 in. from outside of rail, notched down and securely fastened to the stringers. Inside guard rails of $4 \times 3 \times \frac{7}{16}$ in. angle iron are placed 7 in. from the rail; the 3-in. leg being turned toward the rail and bolted to the ties by $\frac{5}{8}$-in. countersunk bolts. A 4 in. $\times$ 4 in. strip is to be placed against the back of the angle iron, in order to furnish additional resistance to an overturning tendency in case of a derailment. Plank 2 $\times$ 9 in. will be placed on the ties between the rail and the outer guard timber; this plank, with the horizontal leg of the inside guard rail, will effectually prevent the cutting of the ties by the flange of a derailed wheel.

The foot walk is laid with $2\frac{1}{2}$-in. plank, laid close and securely bolted at every support. The telegraph wires which now cross the bridge will be placed in a box on the outside edge of each walk, thus forming a foot-guard. This, with the wire rope hand-rail now on the bridge, will render foot passage for the employés over the lower roadway as safe as could be desired.

All the timber used is selected long leaf yellow pine.

Iron ties will be used in the abutments and piers. These will be made out of the 12-in. channels taken out of the bridge and will be bedded in concrete. Re-railing frogs will be placed at the ends of both tracks.

The contract for furnishing the beams, stringers, etc., ready for erection was awarded to the Edge Moor Iron Co. in February, 1888. The work of reconstruction was commenced, June 20th, with the west-bound track on the east span, and this portion was finished in 19 working days. The track is taken by the bridge gang at 8:30 a. m., and given up at 4:30 p. m. It is confidently expected that the entire work will be completed by Nov. 1.

Notes on Fuel and Combustion.

BY R. H. BUEL, C. E.

III.

VEGETABLE FUEL.

Under this head are comprised such substances as *wood, wood-charcoal, peat, sawdust and tan*; or, in other words, varieties of solid fuel which have not been converted into minerals by the action of the sun's heat.

Wood.

Wood is a vegetable structure, the solid portion of which is composed of cellulose or lignin, a chemical compound of carbon, hydrogen and oxygen, united either in the proportion, by weight, of 6 carbon + 10 hydrogen + 5 oxygen = $C_6 H_{10} O_5$, or in some multiple of these proportions, such as $C_{12} H_{20} O_{10}$, or $C_{18} H_{30} O_{15}$, according to different authorities. The cells of wood are also encrusted with coloring matter and resins, to a varying extent in different varieties.

All wood, either when growing in the form of trees or when felled and dried in the air, contains a considerable quantity of water—from 30 to 50 per cent. of its total weight when freshly felled, and about 20 per cent. after being dried in the air. If this latter moisture is expelled by heat it will be quickly reabsorbed by the wood when subsequently exposed to the air.

Woods are classified as *hard* and *soft*, these terms referring to the density of the wood or the compactness of its fibrous structure and the size of its fibres. It is supposed that the actual solid portions of all varieties of wood have about the same specific gravity, since their constitution is essentially similar; and that the difference in the specific gravity of hard and soft woods is principally due to the different amounts of solid material contained in equal volumes. The following summary of experiments, made by weighing different varieties, after expelling the air from the pores and introducing water, is partially confirmatory of the foregoing statement.

Specific Gravity of Wood.

Variety of wood.	Specific gravity (water of maximum density = 1).		
	Freshly felled.	Air-dried.	Pores filled with water.
Sycam re.	.904	.659	1.460
Pine	.912	.550	1.462
Linden	.817	.439	1.485
Birch	.901	.627	1.485
Elm	.948	.547	1.519
Beech	.982	.591	1.528
Oak	1.075	.706	1.534

The chemical composition of different varieties of wood varies slightly, as shown in the two tables which follow, the first giving the composition of wood from which all moisture has been expelled, and the second showing the composition of the wood in an average state of dryness.

Composition of Dry Wood (Parts by Weight in 100).

Kind of wood.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Ash.
Average of several varieties	50.0	5.3	41.7	1.0	2.0
Pine	48.4	5.7	45.6	. ..	0.3
Beech	49.4	6.0	42.7	0.9	1.0
Oak	49.6	5.9	41.2	1.3	2.0
Birch	50.2	6.2	41.6	1.2	0.8
Poplar	49.4	6.2	41.6	1.0	1.8
Willow	50.0	6.0	39.6	1.0	3.4
General average	49.6	5.9	42.0	0.9	1.6

Composition of Wood Containing 20 per cent. of Moisture. (Parts by Weight in 100).

Kind of wood.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Ash.	Water.
Average of several varieties	40.1	4.2	33.4	0.7	1.6	20.0
Pine	38.7	4.6	36.5	...	0.2	20.0
Beech	39.5	4.8	34.2	0.7	0.8	20.0
Oak	39.7	4.7	33.0	1.0	1.6	20.0
Birch	40.1	5.0	33.3	1.0	0.6	20.0
Poplar	39.5	5.0	33.3	0.8	1.4	20.0
Willow	40.0	4.8	31.7	0.8	2.7	20.0
General average	39.7	4.7	32.6	0.7	1.3	20.0

One of the best results obtained by the combustion of wood is reported by Peclet. The wood, containing 20 per cent. of moisture, was burned to heat water for a bath, and each pound of the fuel imparted 5,494 British thermal units to the water, corresponding to an equivalent evaporation, from and at 212° Fab., of 5.69 pounds of water.

Wood Charcoal.

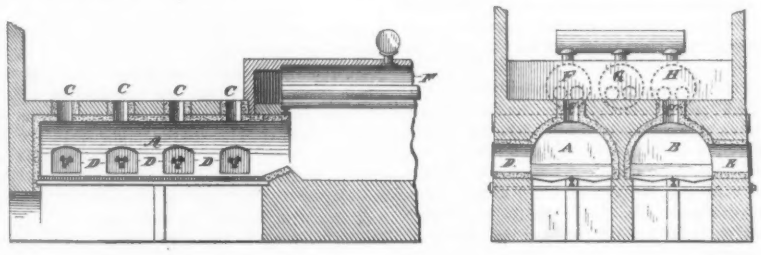
If wood is heated to a temperature less than that of ignition or heated to or above the temperature of ignition in a closed vessel so that combustion cannot take place, the volatile constituents are expelled, and the wood is said to be *carbonized* or converted into *charcoal*. The average amount of carbon in wood containing 20 per cent. of moisture is about 40 per cent. of the total weight, as shown by a preceding table, but a considerable quantity of this carbon is expelled by heat, leaving only about 25 per cent. of fixed carbon or charcoal. In the ordinary process of charcoal burning, where some of the fixed carbon is consumed in the process, the yield of charcoal is from 18 to 21 per cent. of the weight of wood put into the kiln.

The specific gravity of wood charcoal carbonized at low temperatures is about $1\frac{1}{2}$, referred to water of maximum density, and the specific gravity increases with increased temperatures of carbonization, being as much as 2, when a very high temperature is reached. These figures refer, of course, to the *actual*, not the *apparent*, specific gravity. Wood charcoal as ordinarily produced is very porous and in this form its apparent specific gravity varies from $\frac{2}{10}$ to $\frac{4}{10}$.

Wood charcoal usually contains some ash or incombustible matter, the average composition by weight in 100 parts being

Carbon	92
Ash	8

An experiment with charcoal as fuel in the furnace of an elephant boiler (which had given from 8,348 to 11,268 British thermal units per pound of coal, when tested with various



varieties of coal), showed an evaporation from and at 212° Fahrenheit per pound of charcoal of 9 lbs. of water, corresponding to 8,698 British thermal units per pound of charcoal.

Peat.

This form of vegetable fuel is little used in the United States, where coal is so abundant. Its average composition, by weight, parts in 100, when dried in the air, is:

Carbon	45.4	Nitrogen	1.0
Hydrogen	4.6	Ash	1.8
Oxygen	23.0	Water	24.2

In this condition its average *calorific value* (or heat generated per pound of fuel) is 3,250 British thermal units, corresponding to an equivalent evaporation of 3.36 pounds of water per pound of peat.

Spent Tan.

The bark used for tanning leather, after its soluble constituents have been removed in the leach, is ordinarily employed as fuel in tanneries. Experiments on hemlock bark used in a number of tanneries gave the following results :

	Weight per cord. Green bark ground. Lbs.	P. c.	Leached bark wet from tannery. Lbs.	P. c.
Soluble matter	500	= 20	.....	.....
Insoluble matter	1,500	= 60	1.500	= 35.7
Water	500	= 20	2,700	= 64.3
	2,500	100	4.200	100

The composition of this wet spent tan, parts by weight in 100, was :

Carbon	18.1	Ash	1.2
Hydrogen	2.4	Water	64.3
Oxygen	14 0		

Numerous experiments were made with this tan, in furnaces of various forms; and the best result obtained with spent tan containing 61.2 per cent. of moisture, was a calorific value of 1,990 British thermal units, corresponding to an equivalent evaporation of 2.06 lbs. of water per pound of wet spent tan. The furnace in which these results were obtained, designed by Mr. J. B. Hoyt, is shown in the above cut. It will be seen that it is a detached furnace, placed near but not under the battery of flue boilers *F*, *G*, *H*, the space above the furnace forming two ovens *A*, *B*. Ordinary grate-bars are used, placed close together. The furnace-doors *D*, *E* are kept closed, except when the fire is to be drawn or cleaned; and the fuel is introduced through holes *C* above the ovens. Except at the times of firing, these holes are closed by plugs of spent tan. From time to time, as required, the holes are opened, and tan is admitted into the furnace, as much as will run in freely, forming a series of pyramidal heaps on the grate-bars, and the feed-holes are again closed. The grate-surface is quite large, about $\frac{1}{5}$ of the heating-surface.

Furnaces for spent tan and sawdust, especially the latter, are frequently placed under the boilers, and the necessary draft is secured either by a very high chimney or by blowers, but the arrangement just illustrated is more economical and more easily managed.

Straw.

In localities where straw-threshers are used in the field a portion of the straw and chaff issuing from the machine is employed as fuel. The furnaces of straw-burning boilers are usually fitted with automatic devices for feeding the straw; and the furnaces themselves are often of special form. In an experiment made with a portable engine adapted for using straw as fuel, the calorific value of the fuel was 1,866 British thermal units, representing an equivalent evaporation of 1.93 lbs. of water per pound of wet straw.

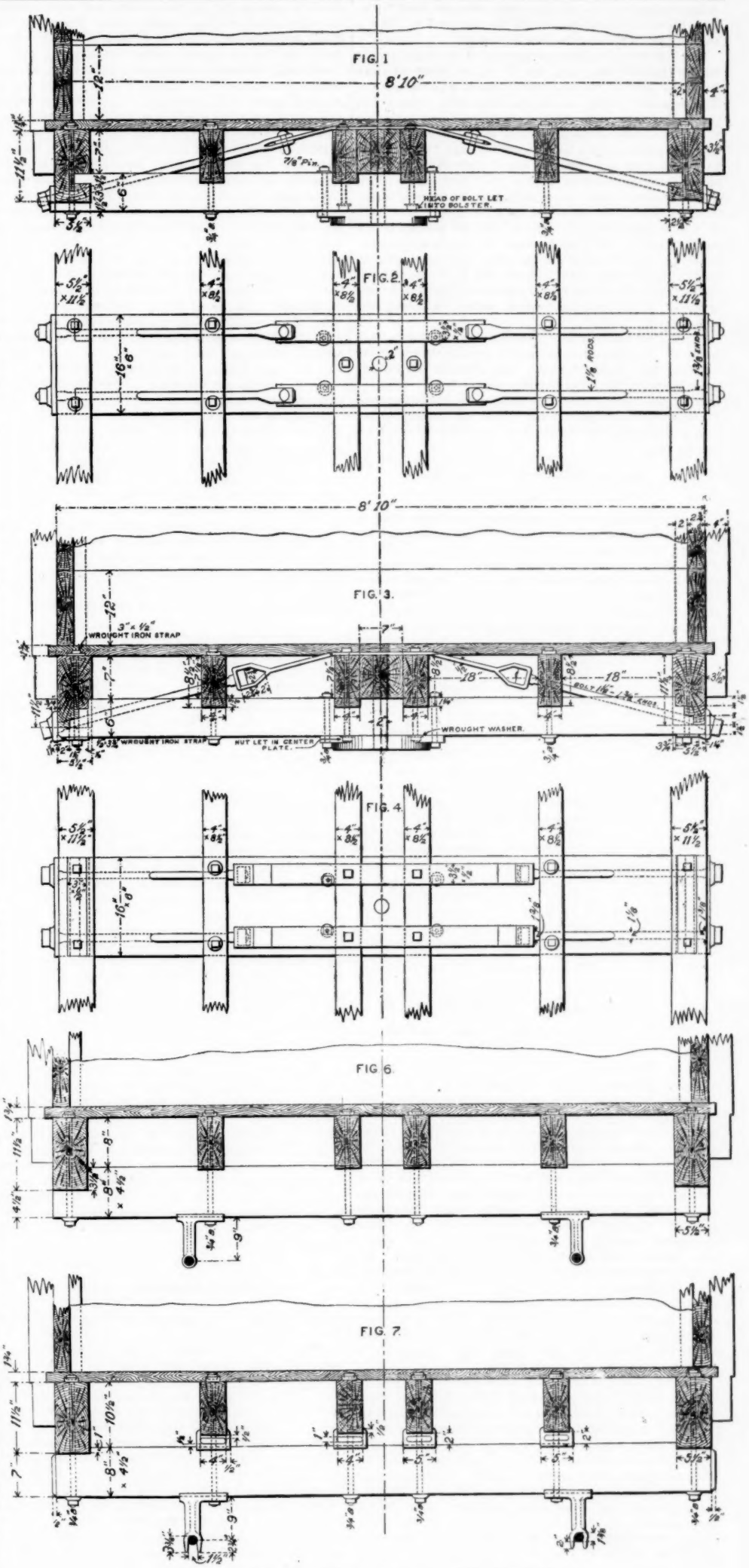
Some Improved Details in Car Construction.

It became necessary some time ago to remove a body bolster from a large newly designed freight car of 60,000 lbs. capacity, a standard type for one of the largest roads South. Attention was drawn to the enormous amount of labor its removal necessitated, and the disfigurement caused by tearing the car to pieces made the job after being finished no pleasing object to look upon.

Figs. 1 and 2 in the accompanying illustrations show the manner in which the bolster is confined to the car, Fig. 1 being the cross section and Fig. 2 the plan. The end sill was first removed entirely, then a portion of the stake sockets were taken off, and the vertical rods which pass through the side of the planks and side sills were taken out, they being over five feet long; then the sides were raised up three or four inches, long chisels were driven between the floor planks and sills and stringers to cut the nails in two. This done, timbers were wedged between the centre and intermediate stringers and side sills to press the sills out from the tenons on the bolster. After all this work it was found that the sills could only be pressed about 1¼ in. from the bolster, unless the car was literally pulled to pieces, and the tenons on the bolster being 2⅛ in. long, the only alternative was to cut the tenons off; this was done by running a saw close against the inside of the sill, leaving the tenons 1¼ in. long instead of 2⅛ in. Of course the tenons on the new bolster had to be cut 1¼ in. long also in order to get it up in its place. This was now soon done and the car finished after considerable bruising and scarring.

Figs. 3 and 4 show a plan which might be suggested as a remedy for the above trouble. Instead of the bolster being tenoned into the side sills, it is stepped as shown, and a wrought-iron plate ½ in. × 3 in. × 16 in. on top of the sill, and another ½ in. × 3¾ in. × 16 in. at the bottom of the bolster with the two ¾-in. bolts passing through them. The straps are suggested instead of the cast washers in this particular place, because of their greater bearing surface. In screwing these bolts hard up, the washers become buried in the wood so deep that they cause it to crack and split, and sometimes the nuts are screwed up to the end of the thread, and still the work is not drawn up in its proper place.

The truss rod washer plate is provided with a lip on the under side as shown. The truss consists of stirrup straps and bolts as shown. The centre stringers are held to bolster by two bolts instead of one, said bolts passing through stirrup straps with nuts on bottom side of bolster. It is important that the bolster should be secured to the centre stringers as firmly as possible. The centre plate is provided with four pockets the shape of the nuts and washers, so as to allow it to up in its place.



SOME IMPROVED DETAILS IN CAR CONSTRUCTION.

It will be seen now that in order to remove this bolster all that is necessary is to take off the centre plates, take out the truss bolts and undo the nuts on the vertical bolts. This method of securing the bolster to the sill is a very strong and substantial one, as well as being simple and cheap. It will be noticed that the stringers on this bolster are so arranged as to give it ¼-in. camber, which is a very necessary feature in the construction of cars. The top of the intermediate

stringers stands 7⅛ in., and the centre stringers stand 7¼ in. from the top of the bolster, while the sills are 7 in. This is so arranged as to make the floor lie straight.

Fig. 6 shows the tie beam arragement of the same car. It will be noticed that there are 3½ in. of wood cut away from the stick at the end that connects with the side sill. This weakens it very much, and they often break at this point, the crack commencing at the corner and extending toward the centre of the car. It will also be noticed that the hog rods pass through a hole in their bearings. This is done to prevent them from jumping out of their places when the centre of the car is sprung upward from hard bumps. This is very frequently done by rough handling in forming trains.

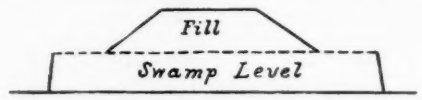
Fig. 7 shows a way in which the ends of this stick may be 7 in. instead of 4¼ in. This is done by placing hollow cast iron blocks, 2 in. deep, between the beam and stringers, as shown. These blocks are provided with ½-in. gibs extending up the sides of the stringers and down the sides of the tie beam, with a hole in their centres for the bolts to pass through. In this case the beam is sufficiently strong and proportional,

The hog rod bearings have grooves 3⅝ in. deep for the rods to lay in; their extended sides are to prevent the rods from breaking them, and at the same time allowing the rods to move downwardly at the bearings on the beam, instead of moving horizontally over the bearings on the bolsters and through the holes in the end sills. They can also be replaced in case of breakage or any other cause without taking down the hog rods.

Swamp Embankment Stability.

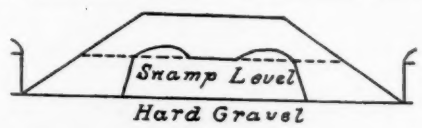
BY SAMUEL M'ELROY, C. E.

Large expenditures and serious losses sometimes occur in the construction of railroad and other embankments over swampy or yielding ground In the vicinity of Brooklyn, Jersey City, etc., salt marshes are common, not usually of great depth and underlaid with firm water gravel, and in other localities similar salt or fresh water formations are common, of various depths. Street and railroad banks are sometimes built across such material in the manner indicated in the annexed sketch. The peat bed is here shown as used



for a borrow pit, but it is more common to fill across it from the main land on each side. In either case an awkward elasticity is produced in the road bed and some time required to attain anything like solid bearing.

In various constructions of this kind I have followed the theory that *the stability of a bank depends on that of its toe-slopes.* Of course, this refers to banks properly made as to material and consolidation in formation, without which no bank is reliable until it has stopped settling and motion. The general method adopted in such cases is illustrated in the following sketch of the South Side Railroad bank (L. I.) across the Jamaica Creek, where the peat was about 5 or 6 ft. deep, over the usual water gravel bed of the island formation.



A double advantage is secured here in economy and stability of work. Swamp excavation is expensive, and it is very desirable, for time as well as cost, to reduce quantities. This is much favored by leaving a central section of the peat bed under the bank prism, and loading with a part of the trench material. The peat trenches should be so cut as to insure the firm deposit of the filling on hard bottom and give a sufficient width of solid fill at the marsh level. A width equal to the trench depth will usually answer all requirements. In making the bank the outside slopes should be crowded somewhat ahead of the central fill, so as to better insure the compression of the central peat section and the stability of the toe-slopes. The direct effect of trenching the peat in such case is, usually, to drain and prepare it for dry consolidation. It then, with antiseptic constituents, becomes a body slow to change. In some instances, notably in the noise prevention of the London elevated roadbeds, it is used for filling to subgrade effectively. I have found this system very satisfactory in securing solid banks at minimum cost.

My first experience with heavy embankments occurred at Albany, in the blue clay formation, many years ago, when principal assistant in a department in charge of all city public works. A number of contracts were executed for street grading, across a deep ravine containing brick-kiln and other ponds. These contracts were let under a street superintendent, our duty being to stake out work and measure up quantities. In these cases no precaution was taken to hold the toe-slopes, and even with so heavy material, it was common to find large quantities of the bank sliding or breaking away laterally, sometimes raising the bottom of a pond two or three hundred feet away from the line. Enormous losses have occurred in this way, in the experience of most cities, and every engineer of experience can recall railway cases where embankments apparently ready for final estimate have suddenly disappeared. I have known cases, as on the Albany & Springfield Railroad, where a long embankment was not only up to final grade, but actually track laid, and the whole disappeared in one night. Evidently, then, all expensive work of this kind should be preceded by careful sounding and careful study of the crust which swamps usually form. These soundings should determine the method of construction, if they do not change the line, for cases of unusual difficulty.

Assuming construction, the engineer should then determine whether to float the bank or make it solid. There are cases of great depths where flotation is necessary, but they are rare, and it is to be used only as an imperative necessity.

In the remarkable work of a man like George Stephenson, in 1830, on the Liverpool & Manchester Railway, his crossing of the four miles of Chat Moss, certainly rivaled his locomotive success in establishing his fame. In this case the greater part of the swamp was readily drained, and the dry peat itself formed a stable bed, for the light work required. A portion was cross drained and a floating platform of hurdles used, after the upper bed had been properly dried. In some places, here, a side load, about 30 ft. wide, was found necessary, to counterbalance the lift produced by the main bank. Part of the swamp, which required by the profile a heavy embankment, was about 37 ft. deep, with a tough sedge crust. This was slowly and expensively filled in the usual way, apparently without special treatment, and it tested the patience, confidence and pockets of the directors severely. The fill found bottom and bearing at last, and Chat Moss ceased its annoyances; but it cost £28,000 for its road-bed in a day of very cheap labor.

In building the Brooklyn Wallabout Improvement, consisting of extensive and costly granite sea-walls, long piers and a long avenue, in a salt marsh, where the peat averaged 18 to 21 ft. in depth, with a hard pan bed, about 21 to 23 ft. below mean high tide, we had to carry Washington avenue, 100 ft. wide, across this marsh about 1,700 ft.

I found a parallel avenue, several hundred feet west had settled badly, and as the contractors were paid $1.40 per cubic yard, measured in excavation, it was urgent to keep down the expense, for the school in which I was educated. I therefore adopted the method outlined in the following sketch, and the experience of the avenue for 20 years, has confirmed its theory of stability in stable side slopes.

In this case we first made a cut with a spoon dredge, about 24 ft. wide within the outer avenue lines, throwing part of the material on the central section. The effect was to thoroughly break up the tenacity of the marsh crust. The dredge went up one side and down the other, and we then commenced lines of solid dump, about 20 ft. wide, along the trenches on each side, restricting any inside fill to a trench bank lead of 150 or 200 ft. The effect was to give two massive prisms of earth and gravel on each side of the central peat prism, carried to the hard-pan bed, with an outside slope of about one and a quarter to one. When the central fill was completed, the peat was compressed about 33 per cent, and no further settlement or side waste was possible. These side advance banks were made with carts, and about 23 of 28 ft. depth, were filled in water, so that they went solidly home as they advanced. The central team and cart fill of the main avenue was also brought up in layers, above tide level, securing great solidity as it was formed.

There is thus a way to handle treacherous conditions of construction without mistakes, and within narrow contingencies of loss. I have had frequent occasion to test this toe-slope theory, and know its reliability under various conditions.

Side hill locations, like some of those on the New York Central, near Albany, or the West Shore below Albany, are sometimes troublesome and dangerous, especially when rains are thawing ground frost. In such instances care must be taken to drain the sources which saturate the bank, and it will be found that a good trench cut along the slope front, so that the bank in sliding will surge and fetch up on the lower side, will often effectually stop further sliding.

Erecting a Locomotive at Altoona.

The accompanying engravings have been carefully prepared from photographs, and represent four stages in the erection of a passenger locomotive at the Altoona shops of the Pennsylvania Railroad. The engine in question was erected in the phenomenally short time of 16 hrs. 50 min. Many writers in the non-technical press jumped to the conclusion that a locomotive had been built from the raw materials in less than 17 hours, a feat which might well appear to be impossible. An inspection of our engravings shows, however, that the different parts of the engine were not only completed, but to a certain extent assembled together before erection commenced.

Many, like the writer, will recollect the erecting shop of five and twenty years ago, when the erectors had practically to take the frames from the smith's shop and do all the necessary fitting by hammer and chisel, and drill most of the holes by ratchet brace. When the cylinders, slide bars, spring and equalizer brackets and lifting and rock shafts were all securely placed in their proper position, the work of erecting was reckoned to be drawing toward a close. But the march of modern progress has changed matters greatly. The duties of the frame shop, small at first, have grown, and now the frame is not only fitted, squared and drilled before it comes into the erecting shop, but nearly all the brackets and fixtures are attached, including the cylinders and slide bars.

When the work commences in the erecting shop the engine is in the state shown in our lowest illustration. The frames are completely finished, all the cross-bars have been attached and the cylinders mounted on the frames in the frame shop. The cylinders and guides are completely lined up in the same shop, so that when the structure arrives in the locomotive erecting shop, all that remains to be done is to put the cross-heads into the guides, put the pistons into the cylinders and key the piston in the cross-head. No adjustment whatever of guides or cross-head is made in the locomotive erecting shop.

The boiler was then brought in, most of the fittings and tubes having been previously attached, and, generally speaking the 16 hours and 50 minutes work represented the time required for the assembling of the parts, erecting the locomotive, and attaching such parts as are necessary in putting the different parts together.

The time, 16 hours and 50 minutes, is believed to be the quickest time in which anything of this kind was ever done, the best previous record being about 24 hours.

Our draftsmen and engravers have endeavored to reproduce the locomotive in its various stages as exactly as possible, not omitting the stains on the boiler from the oil used in drilling the stud-holes for the hand rail and other brackets on the boiler. The boiler barrel is painted between the second and third stages, and the change of color is clearly seen in the illustrations. The smoke-box, however, is not painted until later, and the oily stains there are still plainly visible in the illustration showing the third stage of the engine's progress. The illustrations show some of the miscellaneous collection of implements which are still the favorite tools of the erecter. The broken anvil, the pinch bars, the flogging hammer and the ratchet brace are, as in times past, more clearly visible than the scribing block, the gauge and the templet. Everything clearly visible has been reproduced in our engraving, with the exception of a collection of damaged hats, which, although artistically perched in prominent position and apparently intended as ornaments, have been omitted.

The following is a specification of the locomotive:

Pennsylvania Railroad.

SPECIFICATION OF STANDARD CLASS "A—ANTHRACITE" PASSENGER ENGINE WITH TENDER AND 62-IN. WHEELS.

Gauge	4 ft. 9 in.
No. of pair of driving wheels	2
Diameter of " "	62 in.
Wheel centres	Cast iron
Tires	Steel
Total wheel base	22 ft. 7⅛ in.
Length of rigid wheel base	7 ft. 9 in.
Diameter of driving axle bearing	8 in.
Length " " "	10½ in.
Diameter of main crank pin bearing	4⅝ in.
Length " " "	4 in.
Diam. of parallel rod bearing, front and back	3½ in.
Length " " " "	3½ in.
Number of wheels in front truck	4
Diam. of " " "	33 in.
Diam of truck axle bearing	5½ in.
Length of " "	10 in.
Type of truck	Rigid centre
Cylinders and steam chests	Outside
Spread of cylinders	77 in.
Diam. of "	17 in.
Length of stroke	24 in.
Position of valve gear	Between frames
Type of " "	Shifting link motion
Travel of valve	5 in.
Outside lap of valve	1¼ in.
Inside " "	None
Lead of valve in full gear	1-16 in.
Throw of eccentric	5 in.
Length of steam ports	16 in.
Width of " "	1¼ in.
" " exhaust port	2½ in.
Kind of frames	Wrought iron, inside
Distance between centres of frames	44 in.
Boiler material	Steel
Thickness of boiler sheets, dome	5-16 in.
" " " barrel, outside fire-box, slope, waist and roof sheet	⅜ in.
Thickness of sheet under dome	7-16 in.
" of smoke box	½ in.
Max. internal diam. of boiler { Wagon top	50¾ in.
Min. " " " " }	49¼ in.
Height to centre of boiler from top of rail	7 ft. ¼ in.
Number of tubes	201
Inside diameter of tubes	1⅝ in.
Outside " "	1¾ in.
Tube material	Wrought iron.
Length of tubes between tube sheets	11 ft. 4¾ in.
External heating surface of tubes	1,134 ft.
Fire area through tubes	2.9 sq. ft.
Length of fire-box at bottom (inside)	9 ft. 11⅞ in.
Width of " " "	3 ft. 5¾ in.
Height of crown sheet above top of grate (centre of fire-box)	3 ft. 1½ in.
Inside fire-box material	Steel
Thickness of inside fire-box sheets—sides	¼ in.
" " " " —front, back and crown	5-16 in.
Thickness of tube sheets	½ in.
Tube sheet material	Steel
Heating surface of fire-box	120 sq. ft.
Total heating surface	1,254 sq. ft.
Fire grate area	34.8 sq. ft.
Max. diam of smoke stack { straight	18 in.
Min. " " " }	
Height of stack from top of rail	14 ft. 7 in.
Width of cab roof	8 ft 11 in.
Height " " from rail	12 ft. 3¾ in.
Width of cab	8 ft 8 in.
Size of exhaust nozzle	2⅝ × 3½ in.
Pressure of steam per square inch	140 lbs.
Nature of fuel	Anthracite coal.
Weight of engine, empty	88,250 lbs.
" on drivers	58,700 lbs.
" on truck	29,550 lbs.
" of engine in working order	96,330 lbs.
" on first pair of drivers	32,530 lbs.
" on second pair of drivers	32,650 lbs.
" on truck	31,150 lbs.
Engine fitted with driver brake.	
Capacity of tank	2,400 gal.
" coal-box	15,000 lbs
Number of wheels under tender	8
Diameter of wheels under tender	33 in.
Material of wheels under engine truck and tender trucks	Cast-iron, steel tired
Diameter of tender truck journals	4 in.
Length of " " "	8 in.
Weight of tender, empty	29,300 lbs.
" " loaded	64,550 lbs.
Tender fitted with water scoop.	

The Bosmann Refrigerator Car.

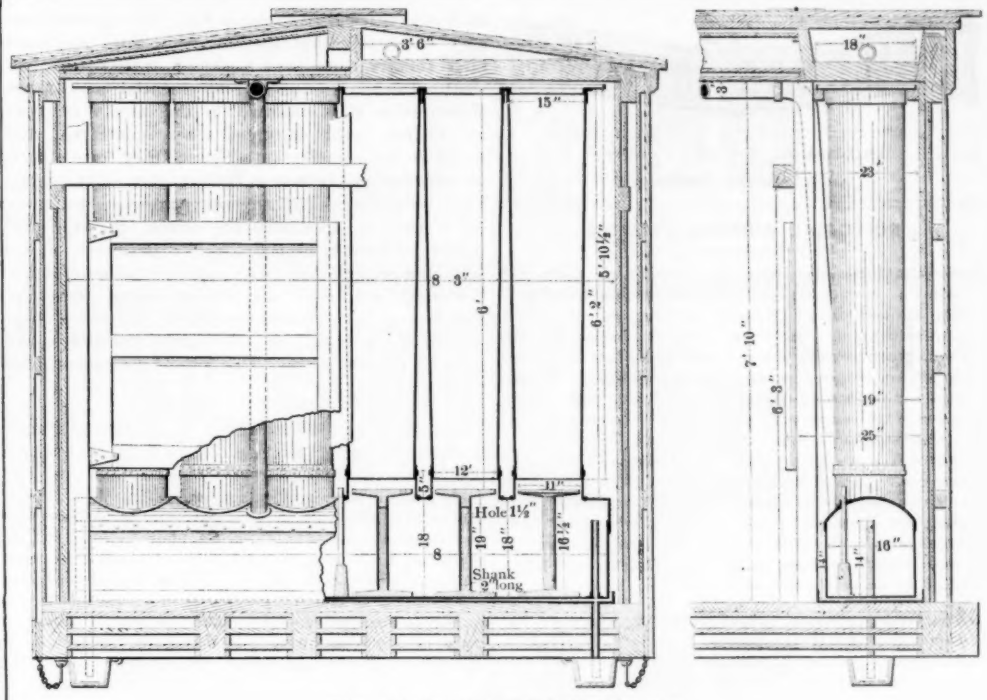
The accompanying engravings show the Bosmann refrigerator car, the views representing a cross section taken near the end of the car and a partial longitudinal section. The metallic ice tanks are tapered in order that the ice as it melts may fall and thus be always in contact with the tank, which in turn is in contact with the air in the interior of the car. The tanks can be easily removed and cleaned in a few moments. The tank at the bottom holds the water from the melting ice, and when this water reaches the top of the overflow pipe it runs off to the trap below.

A 3 in. pipe extends from the water tank below to the top of the car, and from thence under the roof to the centre of the car.

It is claimed that the constant pulsations of the water in the water tank cause motion of air through the pipe, which is perforated at the end, and that circulation of the air in the car is thus induced.

The ice tanks are protected from injury by the doors shown in the engraving and are filled from the roof as usual. It is claimed that tanks made in this form furnish a maximum of cooling surface for a minimum of space occupied at the end of the car, and that a series of trials of this form of refrigerator car have given very satisfactory results.

Any further information can be obtained from Mr. Charles F. Pierce, Home Insurance building, Chicago, Ill.



THE BOSMANN REFRIGERATOR CAR.

The Cost of Producer and Water Gas.

In a paper read by Mr. A. Wilson last May before the Iron and Steel Institute of Great Britain, describing the method of making gas from coke, an operation which first gives off producer gas, and then, when the coke is hot enough, by the admission of steam water gas was generated: the author said that steam in passing through red hot carbon produces a mixture of carbonic acid, carbonic oxide and hydrogen, in which mixture the proportion of carbonic acid varies according to the temperature of the mass of heated carbon when the steam is passing through it. If the temperature is high enough there is no carbonic acid produced at all, only carbonic oxide and hydrogen, so that the water gas which is obtained is composed theoretically of carbonic oxide and hydrogen in equal parts by volume. Carbonic acid passed through carbon begins to be decomposed at a temperature of 868 degrees F. At a temperature of 1,678 degrees F. the proportion of oxide rises to 94 per cent., while at 1,768 degrees F., or 1,000 C., the transformation is complete.

The method of manufacture is, in effect, to induce a rapid combustion of coke, in a properly constructed retort, by means of an air blast, which is used for 10 minutes. During this time a gas, called by Mr. Wilson generator gas, is produced, and taken from the top of the retort. At the end of 10 minutes the coke is hot enough to turn on the steam, which is kept on for 5 minutes, during which time water gas is taken from the bottom of the retort. The generator thus produces, alternately, generator and water gas, the later containing 5 per cent of nitrogen, 4 per cent. of carbonic acid, 41 per cent. of carbonic oxide, and 50 per cent. of hydrogen. The generator gas above referred to should not be confounded with Siemens' producer gas made from bituminous coal. The water gas is, after passing through a scrubber and being cooled, stored in a gas holder and used for lighting by the Fahnejelm's or other incandescent system, and for steel melting and other metallurgical purposes, 17,655 cu. ft. having been found sufficient to melt a ton of steel at the Witkowitz iron and steel works in Austria, the generator gas being used under boilers, etc.

Water gas, by the rapidity of its combustion, presents less flame area than other gas, and consequently a more intense heat. As stated by Mr. Wilson: "A flame of ordinary gas, with the same speed of consumption, possesses a surface six times as large as the water gas flame; and although a cubic meter of lighting gas produces theoretically double the heat by its combustion, the temperature of the flame is at the same much less."

The following comparison of the costs of producer and water gas is given:

Producer Gas.—One ton of slack coal at 5s. 6d. yields of this gas about 150,000 cu. ft., equal to 0.44d. per 1,000 cu. ft.

Water Gas.—One ton of inferior coke at 6s. 3d., yields of this 35,000 cu. ft. of pure gas, and about 140,000 cu. ft. of generator gas, equals 175,000 cu. ft., or at the rate of 0.43d. for 1,000 cu. ft. for the whole of the gas produced.

Mr. Frederick Siemens now sends a circular letter to the technical press showing that since Mr. Wilson's paper has been published Mr. Fox has said publicly that at the Leeds Forge the cost of water gas is 4¾d. for 1,000 cu ft., the cost of a producer gas, made of necessity (not from choice), in the same apparatus being ¾d. per 1,000 cu. ft. Taking 17,500 cu. ft. of water gas as necessary to melt a ton of steel, he makes the two following comparisons of the cost of melting two tons of steel in the Siemens open-hearth furnace.

With water gas.

	s.	d.
35,000 cu. ft. of water gas at 4¾d., per 1,000	13	10
140,000 " producer gas for other purposes, at ¾d. per 1,000	4	5
Total	18	3

With producer gas.

16 cwt. of small coal will melt two tons of steel in the open-hearth furnace heated by radiation, at 5s. per ton	4	0
Labor on gas producers, taken at the high price of 1s. 6d. per ton of coal	1	3
140,000 cu. ft. of producer gas for other purposes—say 16 cwt. of coal	4	0
Labor, as before	1	0
Total	10	3

Mr. Siemens concludes that to melt two tons of steel on the open-hearth, and to provide 140,000 cu. ft. of producer gas of *inferior* quality, the cost with the apparatus recommended by Mr. Wilson is 18s. 3d.

To do the same work, and provide an excess of 140,000 cu. ft. of producer gas of *good* quality, the cost with Siemens' plant is only 10s. 6d., and suggests that manufacturers may well hesitate to adopt the apparatus recommended by Mr. Wilson.

Shop Railroads.

The following paper on this subject was read by Mr. Geoghegan, Mechanical Engineer of Guinness' Brewery, at the recent meeting of the Mechanical Engineers at Dublin:

In many of the large manufactories of the present time the amount of internal traffic soon reaches a point at which horse or manual haulage becomes both inconvenient and expensive, and presents a very serious obstacle to further profitable extension. In extending the premises of Guinness' Brewery in 1873, a narrow-gauge line was designed which was worked by steam. The first difficulty was the difference of level, 50 ft., which had to be surmounted within a very limited area. An hydraulic lift, by which the cars were raised or lowered, one by one, between the two levels, was very slow and costly, involving the separation and making up again of the trains. The author was strongly impressed with the great advantage that would accrue from connecting the two levels, without exceeding the set gradient of 132 ft. per mile. This was eventually done by constructing a spiral tunnel. The radius of the tunnel was settled at 61 ft. 3 in., with 2.65 turns, and the gradient of 132 ft. per mile. The height of the tunnel is 7 ft. 3 in. from the rails, the width 7 ft. 10 in., and the thickness of arch 18 in. The 15 ft. of rise, from the quay up to the bottom of the spiral, is effected by means of a zig-zag incline. For the sake of quickness and convenience in working, this part of the line is constructed with curves, no switches being used; so that a train can be run from the lowest to the highest level, and over the whole extent of the premises, without shunting or changing the engine to the other end of the train. Most of the permanent way is laid with tram rails weighing 56 lbs. per yard. They are fastened to rebated longitudinal timbers, which are laid on cross sleepers, and in some cases directly upon concrete, in which case wrought-iron cross ties are used. The portion most recently constructed has been laid with rails rolled with web and flange, and laid on cross sleepers; the foot is made narrow, in order to allow of its being easily bent to the small radii required.

For switches the tongued point as used on tramways has been adopted for narrow gauge and tram lines; and the frogs, when very close to one another, are made of cast-steel rails bolted upon a cast-iron plate with a wood liner between. The difficulty in finding an engine suitable for the duties led the author to design a special form of engine. The cylinders and crank shaft are placed horizontally above the boiler, and the motion is communicated through vertical coupling rods from the crank shaft to the main driving axle, the upper and lower axle boxes being connected together by a link which keeps the centres at a fixed distance.* The author then described in detail the construction of the engine and of the tip wagons and other rolling stock, signaling, etc.

The PRESIDENT: Mr. J. Ramsbottom, of Crewe, was the first to work traffic with small locomotives at Crewe, on an 18-in. gauge and doing good work. Mr. Geoghegan seemed to have thoroughly considered every fact connected with this question, and they would have very great difficulty in making any suggestion that would be an improvement on what he was doing, moving 1,500 tons per day in crowded shops.

Mr. WILFRED HAUGHTON, referring to the engine in which there was a direct connection by means of a vertical rod, considered that Mr. Geoghegan would find it an improvement to effect the connection diagonally.

Mr. J. A. F. ASPINALL had often wondered why the system of narrow-gauge tramways had not been used much more largely for transferring materials in large works than they had been. One of the great locomotive builders had recently laid out their works with tramways like this having 18 in. gauge. He preferred an 18 in. gauge to anything wider, as it gave facilities for getting in and out of the narrow doorways of workshops, and it also reduced the curves.

Mr. J. HEAD: About 25 years ago almost all the internal work in a large steel and iron works was done by horses, but as the weights to be dealt with increased, only locomotives could do the work. The earlier locomotives were geared, but were found slow and expensive in wear and tear, and were soon converted into direct acting, and they were increased in size. After the development of switching engines the use of horses had almost disappeared, and the two could not work consistently together. If they went in for a tramway system and locomotives, they would soon do without horses.

Mr. LAPAGE: If Mr. Geoghegan compounded his engines he would gain a good deal of economy in fuel. Mr. Worsdell had done this with tram engines, with a saving of 20 per cent. His cylinders were 14 in. and 9 in.

Mr. BASIL WILSON said the question of improving means of transmission resolved into two parts—one the reduction of friction due to the tram lines offering less resistance, and the adoption of locomotives in preference to horse or human power.

Mr. GEOGHEGAN, in replying, said the curves used on their broad gauge line were of as small a radius as 50 ft., and they worked very well. Mr. Aspinall thought an 18-in. gauge better than 22 in. They used as low as 12-ft. curves in the 22-in. gauge, and therefore it was almost as good in this respect as the 18-in. gauge. There was a good deal of horse traffic in their place mixed up with the locomotives, and they never had any accidents. In going round curves, if the coupling was high and the tension on the bar great, the tendency would be to pull the car off the line; but when the coupling was low they could not do so. The spiral tunnel was designed in 1876, and was carried out between 1877 and 1878. It was hardly worth while compounding the engines for the amount of traffic carried on. He admitted the Irish gauge, 5 ft. 3 in., to be unnecessarily wide; but as they could use 50-ft. curves, he thought there was not much to be said against it. The steel tires of the locomotives did not wear out rapidly, though the haulage wagon tires had sometimes worn unevenly.

* An engine of this type was illustrated very fully in the *Railroad Gazette*, Jan. 5 and 12, 1882.

The Thomson-Houston Motors on Street Railroads.

The Thomson-Houston Electric Co. has added two new buildings to its present factory at Lynn. At the present time there are 16 roads in operation using the company's system, and the following will give a good idea of the company's new business, roads in process of construction and those just completed. The overhead construction work at Syracuse is now completed and the cars will be in operation very soon. The road is four miles in length, and will have eight cars in operation. The Lynn & Boston Street Railway Co. has decided to use the Thomson-Houston system for the Highland Line, at Lynn. The road has a large number of curves and grades as high as 9 per cent. The road will be in operation early in September, and will use the single overhead conductor and return rail circuit. The Cross-town Railway Co., of Scranton, Pa., will add four of the improved Thomson-Houston trucks, which will be put in operation this month. Work on the machinery of the Hoosac Valley Street Railway at North Adams is being rapidly pushed forward. The road will be equipped under the Thomson-Houston system, using the single overhead conductor and return rail circuit. The track is five miles long and six cars will be operated. The Revere Street Railway's track construction was completed Aug. 15, and the electrical work on the 16th, and cars are now running regularly. The Des Moines Broad Gauge Railway Co. is to equip its seven and one-half miles of track with the same system and will operate eight cars having the latest improved trucks.

The Suburban Street Railway of Scranton received about two weeks ago an improved motor truck from the Thomson-Houston Electric Co., and two more will be added very soon. The Omaha & Council Bluffs Railway & Bridge Co. will put in a model road, using the Thomson-Houston system. The overhead construction will be used, and the trucks containing all the latest improvements. This road, which is two miles long and on which four cars will be operated, will be one of the finest electric railways in the United States. It will be in operation by Sept. 15. The tracks for the electric railroad at Bangor are now being laid. The Street Railway Co. has decided to use electricity, and has made a contract for a complete equipment. The road will use the single overhead conductor and is two miles long, and will operate 10 cars, each equipped with a 20 horse-power Thomson-Houston motor. The Seattle Electric Railway & Power Co. is a corporation in Seattle, Washington Territory, which is composed of the Seattle Street Railway Co. and the West Street, Lake Union & Park Transit Co. These two companies have decided to unite their interests and equip their entire system with electricity, and have contracted with the Thomson-Houston Co. for the equipment of their road. The road, which is to be in operation by Jan. 1, is 4½ miles in length 3,500 ft. double track, and will operate five cars.

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

In connection with discussions as to methods of settlement of through billed freight accounts, some recent changes in the Austrian Railroad Clearing House are not without interest. Under the old system, calculations were based on way bills forwarded with the necessary corrections; under the new system they are based on results at the point of delivery, or presumably on way-bills received. In spite of the delay thus occasioned the change works remarkably well—so well that instead of its precarious and uncertain existence of a year ago the Clearing House now stands on a firm footing. Within the past few months, in addition to its regular work, it has been entrusted with the settlement of balances on pooling contracts. These are, perhaps, more numerous in Austria than anywhere else. They are not confined to the different private companies, but are entered into by the state railroads as actively as by any one else. Indeed pooling, so far from being prohibited, is all but compulsory, and the work of the Austrian clearing-house is not at all unlike that of the Atlanta office of the Southern Railway and Steamship Association when its power was greatest.

It is stated that all facing switches on the New York, Lake Erie & Western have been provided with standards 16 ft. high, in order that the targets or the switch lamps may be seen more readily. This very necessary and sensible precaution should materially lessen the number of accidents from misplaced switches. It is to be hoped that the addition of distant signals and the concentration and interlocking of switch and signal levers will follow. The recent accidents from misplaced switches at Asbury Park, Corning and other points would probably not have happened had these well-known precautions been used.

Plain smokestacks without any ornamental rim or cornice round the top are being tried on many roads and are now the standard on several large systems. This style of stack is somewhat cheaper than any other and is at least equally efficient, for some claim that the rim creates an objectionable vacuum, which hinders the free escape of the smoke, which instead of ascending so as to be clear of the train, spreads in an attempt to fill the vacuum caused by the large rim. This argument may have something in it, but the appearance of a stack is much enhanced by some ornamental molding, which, even if small, gives the stack a finished appearance, which is lacking in the perfectly plain cylindrical or slightly taper stack.

The erection of a locomotive in 17 hours is not in many respects an important fact. The cost of erecting in such a short time is practically probably rather more than if the parts of the engine were assembled in a more deliberate manner. But the feat is not merely a curiosity or a *tour de force*, but demonstrates very effectually that the men who thus surpassed their fellows were good workmen, masters of their craft. The most valuable and essential part of the organization of a railroad is the men. If they are skilful, hard working, sober, contented, and proud of the organization of which they form a part, the railroad will be able to compete favorably against other lines possessed of superior material equipment but worked by men who are either idle or discontented, embittered by jealousies or possessed of less skill and experience. Any demonstration of superior skill and power of accomplishing work is, therefore, a valuable testimony to the superior organization of the road, for the highest function of the superior officers is the selection of an efficient staff throughout.

The following quotation from an account of a semi-annual meeting of an English road, the London & Southwestern, supplies food for reflection:

> The melancholy accident at Hampton Wick cast a shadow over the meeting. The earnings of the company would have allowed of a ¼ per cent. more dividend, but the chairman, Mr. Dutton, thought it more prudent to carry over an unusually large balance. The accounts showed a decrease of over £6,000 in the expenses of the locomotive department, which the chairman attributed to the decreased consumption of coal, owing to the vortex blast-pipe invented by the locomotive superintendent, Mr. Adams.

The mistake of one engine runner, who forgot for a few minutes that he was running on the wrong track, caused a perceptible decrease in the net earnings of a company receiving some $200,000 per week. On the other hand, a plain and simple improvement in the blast pipe involving no extra parts and no additional cost of construction has for the last four years caused a progressive decline in the coal bill, for the saving during the last half year compares with a similar decrease in the fuel account in the corresponding period of the previous year.

Cases of extraordinary locomotive mileage between repairs are often published, but in many of these cases it will be found that the engine was allowed to get into a practically dangerous state of bad repair, and finally the absolute need of the deferred repairs is demonstrated by a bad case of leaving the track owing to bad tires or the fracture of pins or rods owing to excessive lost motion. The penalty that has to be paid for the achievement of having made an unusual mileage generally sweeps away any supposed saving in the long run without heavy repairs. The risk of a fatal or disastrous accident has also to be taken into consideration, while the delay and interruption to ordinary traffic caused by a breakdown are not insignificant items. Many failures of locomotives are caused by a want of inspection rather than by undue wear, for flaws develop slowly and can be generally detected in time by periodical inspection. When, however, an axle, the failure of which may wreck a whole train, remains practically unseen for years, while the locomotive is covering an enormous mileage, the neglect becomes almost criminal. In a recent case the truck axles of a passenger locomotive remained unexamined while the bending strains on each axle were diametrically reversed over 200,000,000 times. This period would certainly permit of ample development of any flaw, and it is not surprising that an expensive failure is the penalty which frequently accompanies such cases of extraordinary mileage.

Something About Rail Joints.

Amongst the topics which the Roadmasters are to consider at their Washington Convention, that of the joint is probably the most important, and certainly the one which has been most discussed. We have no intimation of the order in which the various aspects of the topic will be discussed by the Roadmasters, but it would naturally divide itself into three questions: broken or square joints; suspended or supported joints; the type and form of joint.

The New England Roadmasters, in their recent convention, adopted a resolution in favor of broken joints. This, of course, was to have been expected from the well-known facts of the geographical distribution of broken and square joints, which were brought out by the *Railroad Gazette* in 1884, and have now become common property in the discussions of this subject. It was shown then that practically all roads south and east of a line from Portsmouth to Cleveland and from Cleveland to Galveston were laid with broken joints; that all west of a line from Chicago to Galveston and north of a line from Chicago to Portsmouth were laid with even joints, and that between these great groups the practice was about evenly divided. Therefore, a convention of Western roadmasters might have voted for even joints. Yet it seems probable that opinion is setting in favor of broken joints. Whether or not this is so cannot be positively said without comparing facts gathered from a great many roads, but from the expressions of individuals it seems likely.

It is pretty generally held that on well-ballasted track broken joints are to be preferred, while on poor track even joints are better. The theory most generally accepted has been that, with an unballasted track and weak joints, the motion caused by low joints will be complicated by sidewise oscillation in case of broken joints. It is not at all certain, however, that this amounts to a practical objection, and it is a question if this whole theory that even joints are to be preferred for poor track did not grow up from an attempt to account for the geographical distribution of the two methods of laying track. We are inclined to believe that on any track which is safe for ordinary passenger traffic it will be found that, other things being equal, broken joints will ride smoother than even. But one wheel of a truck can go down at a time, and meanwhile the load is sustained at the proper level by the other three; and in no event can the drop of the car be as great as if two wheels went down at once. The load is consequently carried over the joint with less injury to track and rolling stock, and with less inconvenience to passengers. In the discussion of this matter at Boston, Mr. Ellis, of the Providence & Worcester, spoke of himself as a somewhat recent convert to broken joints, and told one experience which had clinched the conviction in his mind that they give better results than square joints, even where track is not well ballasted and tamped. In this case he had laid two pieces of track under precisely similar circumstances, except that one piece was laid with square and one with broken joints. Before ballasting and surfacing were completed the ground froze, and the track was left in this condition till spring. In the spring it was found that on these pieces of unfinished track the joints were in a better order when laid broken, the labor of maintenance was less, and the track rode better. Mr. P. H. Dudley speaks unqualifiedly in favor of broken joints, but his dynagraph inspections and records have been made on ballasted track, and probably he would not attempt to decide the question absolutely for poorer track.

If the reason which has usually been given for the extensive use of square joints in the West, Northwest and Southwest is the real reason, it is fortunately passing away. In the great area in which the practice prevails are now long lines of railroad, as well ballasted and kept in as good surface as the Eastern lines, and there, as well as in the East, the strength of joints is being materially increased. We shall not be surprised, therefore, to learn of a growing sentiment there in favor of broken joints.

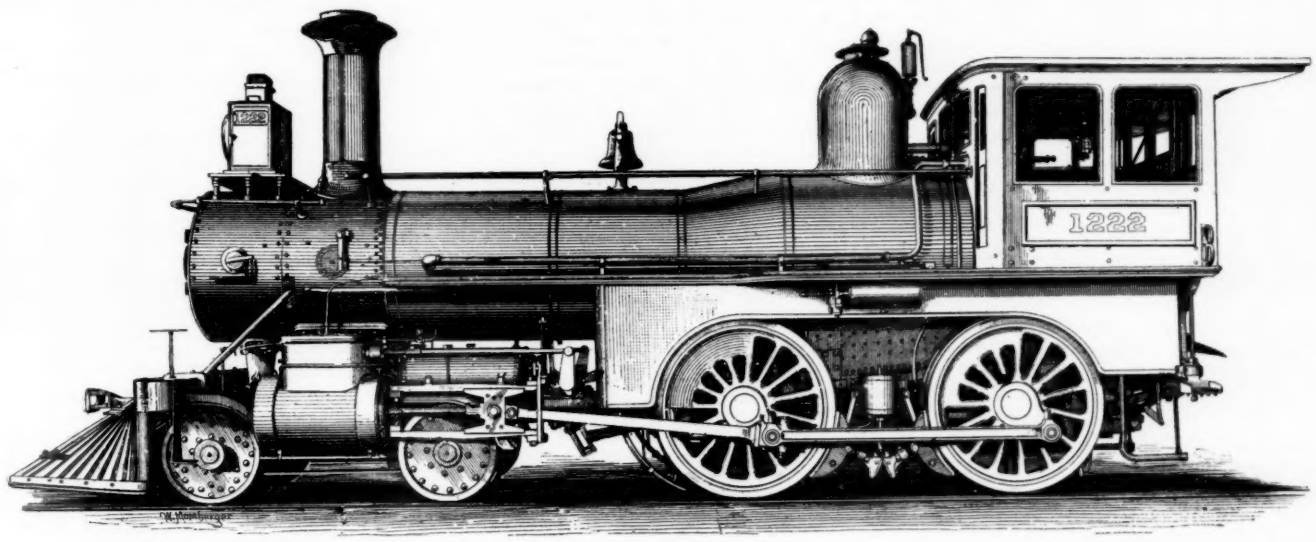
The question of supported or suspended joints seems to be further from settlement. While roads which have lately adopted a long angle bar have used it with a supported joint, a 36-in., six-hole splice is also used with a suspended joint, and those who must be considered as the best authorities are divided in opinion and practice. So far as can be judged without extensive inquiry, the question of supported or suspended joints is still subordinate to that of the strength of the form of joint adopted.

Two or three years ago the question Why do rail joints break? was much discussed, and the discussion added much to the common stock of knowledge of the behavior of joints, but it has been pretty clearly shown that the chief reason was that they were not strong enough. Since Mr. Becker found 27 per cent. of the angle bars broken on a division of six miles, and that they broke most numerously when new, and in entire disregard of the condition of the road-bed and of the mathematical laws, the top flange has come into large use, the weight of the angle has been increased, and it has been found that if they do break they need not.

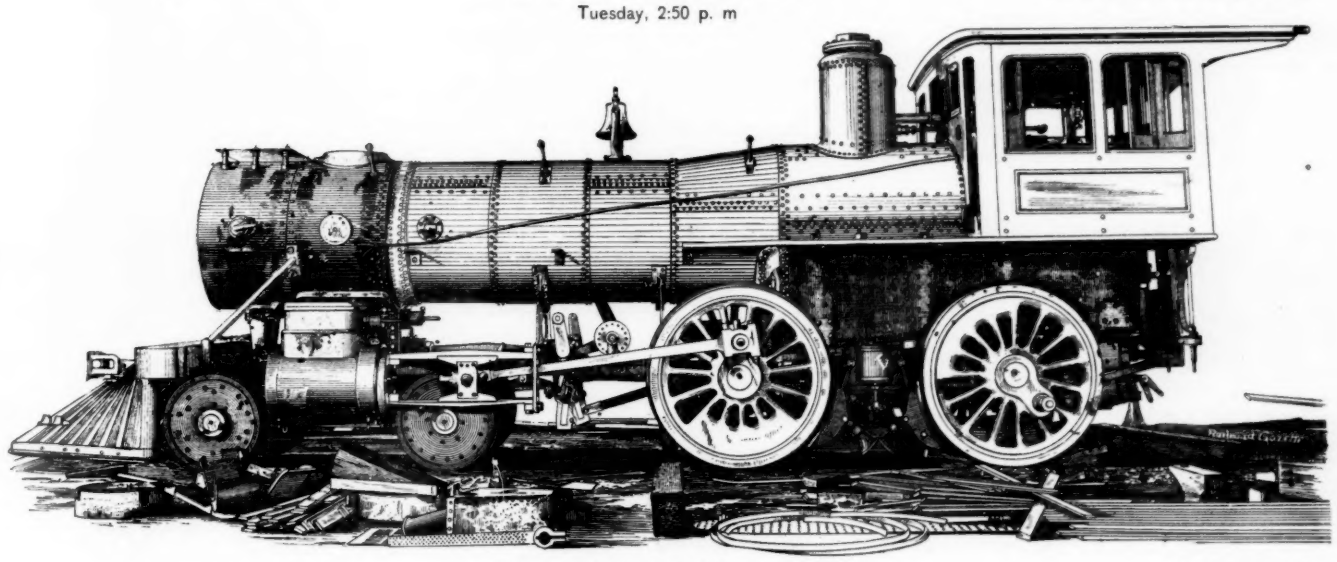
The experience of the Lehigh Valley is well known, and the Fritz-Sayre splice is familiar. As used on the 76 lb. rail it is suspended weighs now, we believe, 56 lbs. per joint, and has never broken. The same design essentially has been used, with lighter rail sections, for 14 years, and but very few broken splice bars have been found with the 66-lb. rail, and but one with the 67-lb., up to a year ago.

The Pennsylvania is using a heavy six-hole splice, 34 in. long, with top flange, suspended, and has "no record of any splices being broken since the use of it began." On the contrary, after this form of joint was adopted, but before the latest heavy rail section was put in, it was found that the joint not only endured but that rails which had been bent with a weaker joint, straightened after the improved joint was put in.

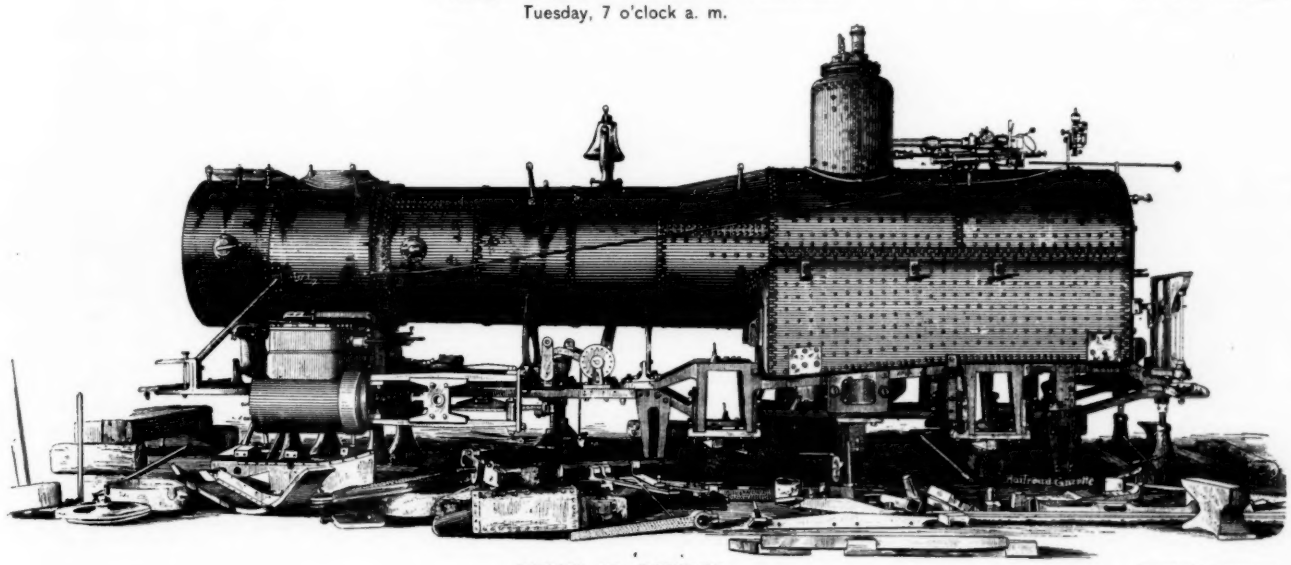
The Erie is using a six-hole angle splice 40-in. long,



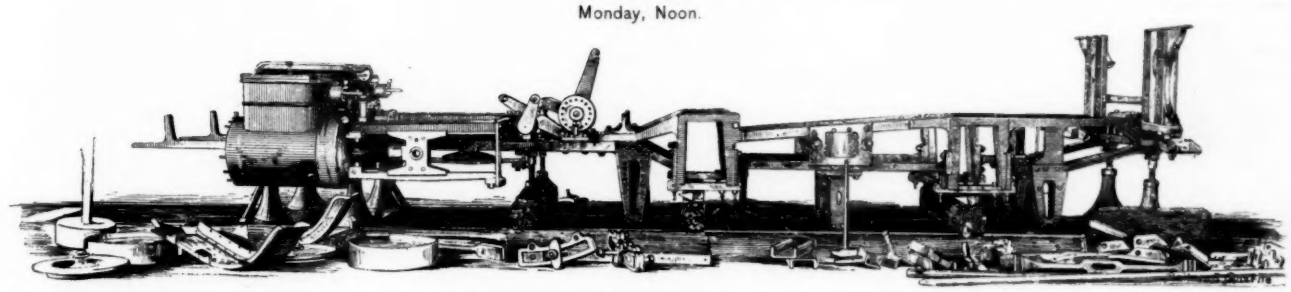
IN STEAM READY FOR TRIAL. 16 HOURS 50 MINUTES WORK.
Tuesday, 2:50 p. m



WHEELS UNDER AND CAB IN POSITION. 10 HOURS WORK.
Tuesday, 7 o'clock a. m.

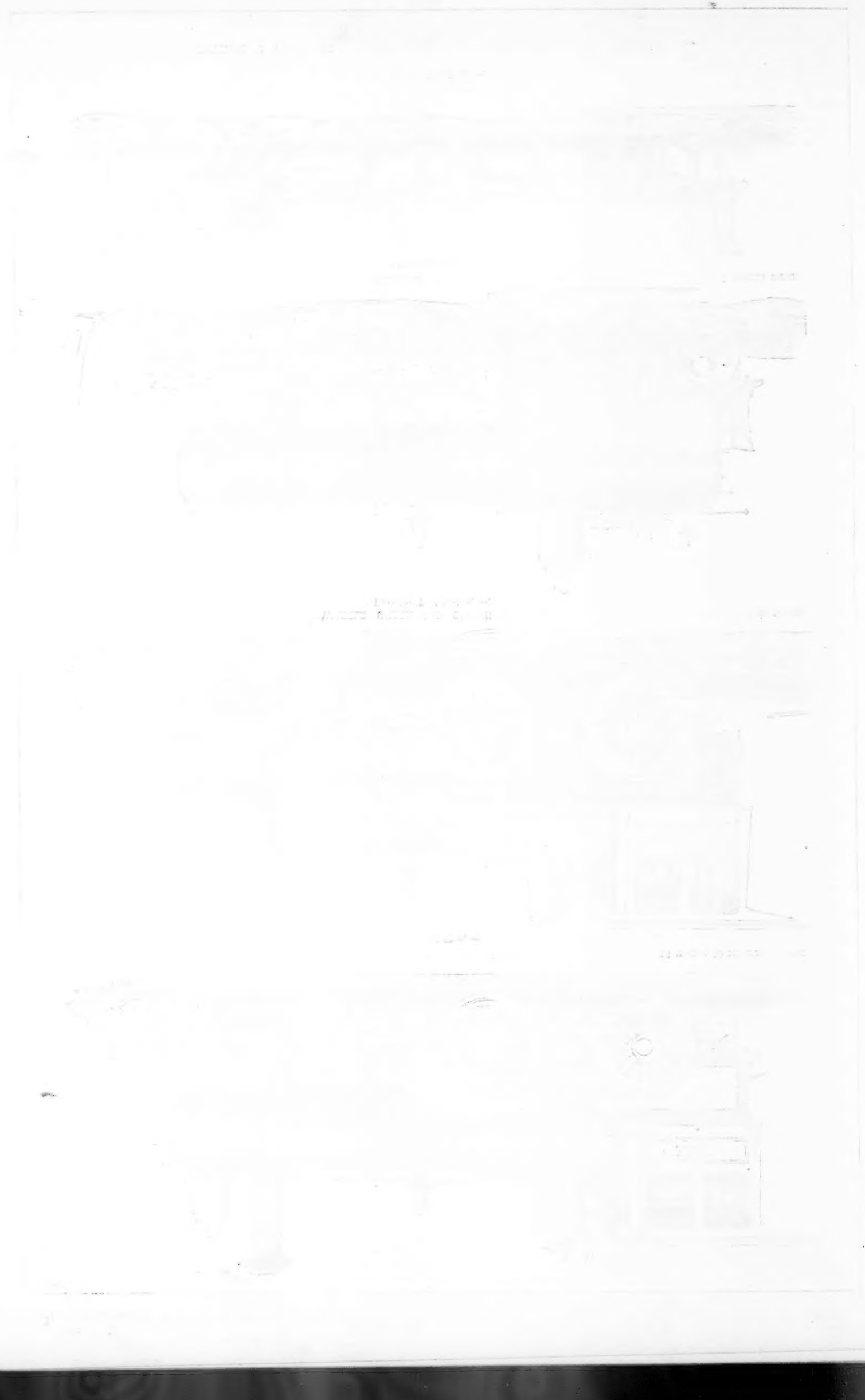


BOILER IN POSITION. 5 HOURS WORK.
Monday, Noon.



COMMENCEMENT.
Monday, 7 o'clock a. m.

ERECTING A PASSENGER LOCOMOTIVE, ALTOONA SHOPS, PENNSYLVANIA RAILROAD
JUNE 18 AND 19, 1888.



weighing 55 lbs. per joint, supported. It is quite similar in section to the Pennsylvania angle. We have no report of the breakages, but it is said that the general verdict is that the long angle bars, with six bolts, supported, are superior to the short ones with four holes, suspended.

The Michigan Central has used a 60-lb. six-hole splice bar, 44 in. long, supported, for three or four years, the breakage of splices on well ballasted track are practically none. We have no data of experience of the Chicago, Milwaukee & St. Paul with its 40-in., six-hole splice, other than the fact that from February, 1887, to June, 1888, the miles laid with it increased from 1,000 to 3,000. Presumably it does not give much trouble from breakages. These examples perhaps do not prove that rail-joints need not break, but they go a good way toward an absolute demonstration.

We may assume therefore that a heavy angle-bar with a top flange is safe from breakage; but the duty of not breaking is only one of the duties of a joint. Its own life is of little importance, as it does not save the rail also. What form of joint, of those now well known and in wide use, best performs this service it is impossible to say, but it is highly probable that a long angle bar, with six bolt holes and a substantial top flange, is the best of any form of the splice joint. If this is supported and held to the joint tie by a clip and interlocking bolts, after the manner of the new joint now going in on some 70 miles of the New York Central & Hudson River,* we should expect from it very excellent results indeed. Even better results may be obtained in time from some joint of the bridge or chair type; but few railroad men will admit now, however, that the type has been enough used to prove its all around efficiency in service. If there is anything in which experience is of paramount importance in forming correct conclusions, and in which speculation is misleading, it is in rail joints.

Improvements in Pennsylvania Locomotives.

The Pennsylvania passenger locomotive illustrated on another page is not only an example of the rapid progress made in the art of locomotive construction as regards the time in which the different parts of a locomotive are assembled, but the parts themselves embody many improvements unknown a few years ago. The smooth and graceful curves of the dome are conspicuous in the outline of the engine, and though the improvement is not of very material moment, this form is cheaper to make and easier to keep clean than the elaborate moldings in vogue a few years ago. The absence of the familiar sand-box above the boiler is another change that strikes the eye and is really of some material importance, saving the motion from the wear caused by sand spilled in filling the sand-box. The arrangement of the driving springs beneath the box is another recent innovation on the time-honored practice of placing the springs and equalizer above the frame and beside the fire-box. This method is simpler than the employment of numerous equalizers and spiral or "dolphin" springs, and permits the fire-box to be made wider and deeper, while the boxes are more readily oiled and the springs are more accessible. The adoption of a two-bar cross-head in place of the old four-bar arrangement enables the whole width across the bars to be utilized for bearing surface, and at the same time permits ample space for the movement of the rear truck wheels. When we claim superiority for the American as distinguished from the European type of locomotive, it should not be forgotten that all these features have long been in general use in English practice, while the solid-end side rods, though first used simultaneously on both sides of the Atlantic, soon became universal in England, while their use on this side is still somewhat exceptional.

The extended smoke-box and the fire-box placed above the frame and then extended to the full width between the wheels are improvements of purely American origin, and their practical value is daily rendering their adoption more general. The use of steel-tired truck wheels is also becoming very general for locomotives for passenger service, and indeed various forms of steel-tired wheels are often used for tenders and for freight engines. The I section coupling rod is another improvement which though introduced in Germany many years ago, has only of late years been favorably received here. The superiority over the plain rectangular rod is especially noticeable in fast passenger service, and the fact that the Pennsylvania, though using this I section extensively, have had a complete immunity from breakage, shows the greater strength of the girder form to resist the upward and downward cross breaking strains produced by the weight of a rod which changes the direction of its motion some 500 times every minute.

An improvement which has secured rapid and general adoption is the sight-feed lubricator, which is somewhat indistinctly shown in our engravings. The certainty with which a runner can now ascertain the amount of oil which lubricates the slide-valves and pistons has done much to diminish wear and tear and minimize the internal friction of the engine. The forms of the two ends of the connecting rod are also valuable improvements. The cross-head or small end is solid, and the jaw of the crank pin or big end is closed with a block and vertical bolt. The greater simplicity and strength of this arrangement as compared with the straps still so generally used will be self-evident to any mechanic who studies the question carefully. Candor again compels us to add that these two latter improvements are also long recognized features of English practice.

Perhaps the most significant improvement in the locomotive is indicated by the weight. A passenger locomotive with 17-in. cylinders, 63-in. wheels, and weighing 96,000 lbs., would a few years ago have been considered enormously heavy. This weight is now, however, not in excess of the latest practice, and shows plainly that all the parts are now made stronger and therefore heavier. The increased area of bearing surfaces, the greater thickness of boiler plates and the more liberal provision made everywhere to guard against the effects of wear and deterioration, all tend to make an engine which is not only more durable but is less liable to sudden failure than the light locomotive built a few years ago. The increased dimensions of the various parts are shown in detail in the specification, but the greater weight in working order shows plainly the effect as a whole of the increased proportions.

Passenger Conductors.

The passenger conductor has been an important figure in American life for the past fifty years. Many of the men who have filled this position have possessed that force of character which renders a man influential in any surroundings, and strong traits have been developed by the nature of the duties of the position. In the course of enlargement and systematization of railroad business there has been some change; the calling is now largely one of routine and machine methods, and the incumbent cuts less of a figure in the world. The importance of the office has not by any means vanished, however, and the problems attending its administration still worry managers.

Lately there have been a number of reports from various sections of the country of the discharge of a dozen or a score, more or less, of conductors, under circumstances which lead every one to assume that dishonesty was the cause of the action taken. Several roads have contemplated employing train collectors, and two or three have actually put them on. These circumstances and others show that the passenger train department cannot yet be trusted to run itself. The Atchison, Topeka & Santa Fe has employed train collectors for a year or more, and appears to regard the system as of permanent value. Wholesale discharges generally are not explained very fully, and the reason given for employing collectors is the desirability of enabling the conductor to give his entire attention to the management of his train; but a little investigation shows that unsatisfactory financial results are at the root of the matter in all cases. The relief of the conductor from the exacting clerical and financial duties of his position is indeed a thing to be desired, but increasing the pay roll of the passenger train service 25 or 30 per cent. for the attainment of that object is a step which superintendents will not take without very strong reasons. Financial irregularities demand vigorous treatment, of course; but is the prevailing practice the best that can be devised?

Honesty is a necessity in any business. The worst hot bed of sharpers in the world has to have an elaborate code of rules founded upon honest methods, and confidence between man and man is really a great factor in the dealings of "sharps" and "flats" alike. A conductor should be honest, whether he runs a passenger or a freight train, or even an empty engine. There are a hundred relations between the division superintendent and his conductors, both freight and passenger, which can remain natural only while there is confidence; but the pretense that there is confidence, while actions show that there is distrust, is the thinnest sort of veneer. But it is almost a wonder that any passenger conductor is honest. The American system of fare-collecting is one of the most absurd things in the world. The temptation to passengers to cheat the conductor, and to the conductor to cheat his employer, is constant and great (at least on way trains). So long as present methods are continued there certainly can be no hope of securing satisfactory results, except by the most constant and intelligent care. It may be possible to walk on eggs, or to make gunpowder in Hades, but these things can only be done by close personal attention to details.

But something must be done. The conviction that hundreds of thousands of revenue fails to reach the company's coffers impels to vigorous action. If we cannot get a better system we must try and purify the one we have. Superintendents seem discouraged, and the prospect of accomplishing a reform acknowledged to be necessary is apparently regarded in many quarters as a dreary one. Which way shall we turn? Assuming that the employment of train collectors leaves us with a remedy nearly or quite as bad as the disease, how shall we get faithful conductors?

There are certain fundamental principles that cannot be ignored. 1. Honest men find no personal imputation in removing temptations from their path, or in having them removed by their superiors. Railroad treasurers, bank cashiers and station agents do not feel insulted to be under bond and to have their money counted by an auditor at any time. The unexpected visits of the latter officer are the same in principle as the much criticised spotter's work. Conductors as well as station agents and others, *who are not dishonest*, occasionally become careless and negligent of their employer's interests; and the whole body should cheerfully submit to investigation for the purpose of correcting irregularities of this kind. No individual can reasonably object to it. But the superintendent owes it to his men to fully explain to them the plan of supervision that they are to work under, and to have auditors, examiners or detectives who are as much above suspicion as the chief auditor himself. Trainmen of all grades should understand that their work in all departments, financial or other, is to be examined at *any* time. *Make* them understand these points. Don't trust to a half dozen lines in the book of rules, or to a circular, but find out by questioning, taking plenty of time. It will pay in the strengthening of mutual respect, which is an important element in the business of the train master's office and conductor's room, as well as elsewhere. Secret examiners should be persons in whom the superintendent has perfect confidence. This assurance will give him an important additional leverage. The feeling of men that they, being regarded as thieves, have thieves set to catch them, is perhaps a silly whim, and one that does not rankle in the breasts of many worthy conductors, but it is entitled to respect nevertheless. It is by no means boy's play to get secret examiners whose honor you would defend as your own, but it pays to try. Opinion among superintendents as to the worth of professional detectives is divided, but those who do without them, and yet keep track of the business, seem to prove, by their results, the correctness of their theory.

2. The *plan of selecting* conductors is of the first importance. A blunder or lack of energy here will neutralize any amount of good work afterwards. Men who, like most baggage-masters and freight-conductors, have never been accustomed to the constant handling of others' money take a fiduciary place with a distinct disadvantage at the outset. A 15-year-old boy who has worked a year for the treasurer, or in a ticket or telegraph office, would have the advantage of them because of his *habit*. Train collectors are put on because it is believed to be easier to get the right kind of men out of the circles they are selected from than from the train service. This is in a degree true, for there are a hundred smart, "clerkish" young men where there are a dozen, or perhaps five, good trainmen fit to be polished up for passenger conductors. It is clear, therefore, that if conductors are to be made from the lower grades it will be necessary to take great care in the selection of the men for these lower grades. To find men such as you want for passenger conductors you must begin back; not a hundred years before they are born, as Dr. Holmes says, is necessary in educating a child, but yet a good distance. To expect to get good passenger conductors out of rowdy freight conductors or lazy baggage-masters is the acme of unreason. The selection of passenger conductors is specially difficult on some roads where the passenger traffic is large in proportion to the freight, and is growing difficult by reason of other and minor changes in the service. There is therefore no denying that to secure a good body of passenger

* *Railroad Gazette*, March 30, 1888.

conductors by the means here outlined is a slow and not particularly easy process, but what other way can be found?

3. Some division superintendents can, with their eyes shut, pick out good men more successfully than can others after extensive inquiry. Most superintendents have doubtless seen the installation of appointees, whose unfitness they could have predicted at the outset, but which seemed to be apparent to the appointing officer only after the proof of experience. The superintendent who is not a fair judge of human nature should at once block out the first draft of his letter of resignation. There are men who, any one can see, are pretty certain to be honest, and there are others who would at once be set down as doubtful or "shaky"; but the great intermediate class, whose character is not so plainly indicated in the face, constitute the field for the superintendent's skill. By the aid of his acquaintance with the men he should be able to diagnose them with a good degree of success.

So long as the present American plan of ticket and fare collecting is continued we must not fail to recognize and use the valuable aid of that powerful auxiliary principle, the deep seated trait of the popular heart which delights in saving ten cents. Nothing less than a monster railway corporation, perhaps, could so fully depend upon this feature; but it is providentially here and let us make the most of it. People who waste five dollars, or even twenty, daily, will exert the full power of a brilliant mind to "baffle the railroad in its attempt to defraud." Therefore always collect a higher rate on the cars than at stations. This will make people buy tickets, or tend powerfully to secure publicity if they do not. Tell the conductors that an unexplained deviation from this rule will be a most serious offense. If the law requires the additional charge to be refunded, it can be easily done, as is the practice on many roads. With a ten cent excess or rebate, with energetic and intelligent efforts to get honest men, a business-like system of cash-fare collection and a frank explanation of it to all concerned, any road should be able to secure a reasonably satisfactory service. At least there are prominent roads that do secure it. That trouble and vexation will be experienced as long as employés, high or low, are kept in their places for any other reason than efficiency is the most patent of truths; but it is one that will bear a good deal of thinking about.

Fire-boxes and Fuel.

In considering the question of the most suitable form and size of fire-box for burning inferior fuel on a locomotive, care should be taken to distinguish between small coal and dirty coal. It is true that the two terms are often synonomous, but it is not always true that all small coal is full of dirt, and few would care to assert that all dirty coal is small. In either case, the useful work done by the coal will depend upon the amount of combustible matter it contains, and the heating surface and cubic contents of the fire-box should be proportioned to this amount of combustible matter rather than to the gross weight of the coal. The fire-box and heating surface have mainly to deal with the products of combustion, and to develop and extract all the heat possible from the combustible matter.

The grate, on the other hand, has to deal with the gross mass of the coal. If the coal is nearly pure, or, in other words, contains little ash, it will continue burning for a long while and leave the grate unincumbered; but if the coal is dirty, the resultant ash and clinker will accumulate, either filling the ashpan or blocking the air way through the grate bars. The combustion will therefore be imperfect, and it is obvious that any excess of heating surface will not mend matters. Either nearly the whole supply of air must be admitted above the fire, or the grate bars must be cleaned. The latter method must ultimately be resorted to in all cases, for it is evidently only a question of time when the fire-box would be filled with ashes and clinker. It is therefore not surprising that shaking grates and drop plates are in very general use, while the admission of air above the burning fuel is the exception rather than the rule. It is obvious that the need of a shaking grate and the admission of air above the fuel apply to a dirty coal, whether large or small. If a given coal is broken up the amount of dirt remains practically unaffected unless it is picked out by hand, and as the dirt cannot be burnt, it must be got rid of, whether the coal be originally large or small.

The size of the coal does, however, influence considerably the size of the grate mainly on mechanical rather than on chemical grounds. The finer particles necessitate a closer spacing of the grate bars and consequently a smaller air admission in proportion to the gross area of the grate. But as small coal burns best in a thin fire, this diminution of air way is especially prejudicial. The draft is not only sharper but it encounters less resistance, owing first to the smaller size of the individual particles of coal, and secondly, owing to the thinner layer of coal through which the air has to pass. The greater velocity of the entering air tends to lift the fire, making sparks, and as the fire is thin, it is soon burnt into holes.

The mechanical effect of the upward rush of air on the small coal may be diminished either by decreasing the volume of the air or by distributing it over a larger area. In other words, a larger proportion of the total supply of air can be admitted above the grate bars or the grate area can be extended.

A little consideration of these self-evident facts shows the reason why the use of an excessive amount of heating surface has not in most cases given satisfactory results from an inferior fuel. The amount of heating surface depends rather upon the amount of steam to be evaporated in a given time than upon the quality of the coal, but the nature and size of the grate should depend largely upon the size of the coal and the amount of ash and clinker.

The Missouri, Kansas & Texas and the Missouri Pacific.

We give below an abstract of the report of the committee to investigate the relations and accounts of the Missouri, Kansas & Texas with the Missouri Pacific, which has been published within a few days.

The Missouri, Kansas & Texas was organized in 1870 and leased to the Missouri Pacific Dec. 1, 1880. The International & Great Northern in 1881 exchanged its stock, one share for two, with the Missouri, Kansas & Texas, thus becoming the property of that company. For the use of Missouri Pacific engines the Missouri, Kansas & Texas pays $10 per day, or $250 per month. To place the entire property in fair working order would require about $2,000 per mile for 2,369 miles, but if the needs of the traffic are considered $1,200 per mile willbe enough. This expenditure should be spread over three years and is in addition to ordinary road work, equipment needs, repairs and new engines.

The telegraph along the road was sold to the Western Union in 1882 for a nominal consideration.

As regards traffic, the currents of trade have been changed to St. Louis except stock direct for Chicago. The Neosho section does not more than earn operating expenses. Some branches are allowed only a pro-rate with the rest of the Missouri Pacific system, and hence do not earn operating expenses. The lease of the road to the Missouri Pacific provided only for efficient operation, the rental to be the net income after paying maintenance and interest on the debt of $45,000,000. The Ganet-Tucker award, which was made in 1884, fixed the percentages of division of joint earnings and expenses between different parts of the Missouri Pacific system, but there was no representation made of the claims of the M. K. & T. before those gentlemen.

The financial statements show that at no time have the Missouri, Kansas & Texas, or the International & Great Northern, earned their heavy interest charges, although an apparent surplus was shown by a great and illegitimate reduction in expenses of operation. The maintenance of way was cut down to $800 per mile in 1883, 1884 and 1885, and to have kept the road in fair condition would have cost more than the apparent surplus. Besides this, the deficiency in the International & Great Northern was charged up to the Missouri, Kansas & Texas in a round sum in 1886. Had this deficiency been charged yearly it would have eaten up the supposed surplus. At present the deficit on the Missouri, Kansas & Texas is about $2,300,000, and on the International & Great Northern $800,000, making a total chargeable to the Missouri, Kansas & Texas of $3,100,000.

It appears that of the competitive traffic of the International & Great Northern the Missouri, Kansas & Texas carried but 30 per cent., the larger part going over the Iron Mountain; and of the traffic to and from St. Louis and the Texas lines of the Missouri, Kansas & Texas a certain proportion has also been taken away from the Missouri, Kansas & Texas northern lines. This results because the Missouri Pacific operates its system as a whole, and by the shortest lines; if so, the system should stand the losses to the Missouri, Kansas & Texas resulting from this division. Competition with the Atchison and the St. Louis & San Francisco lines has also reduced tonnage and profits. The Minden branch of the Missouri Pacific was built between two local Missouri, Kansas & Texas points, thus taking from the Missouri, Kansas & Texas the haul of through freight for 76 miles. The Holden branch is a part of the main line of the Missouri Pacific and is leased for its pro rata share of earnings, the lessee agreeing to furnish at its own cost all repairs and equipment. By charging to this line all engine and car mileage, the revenue is reduced to $40,000 per annum for 54 miles. A more equitable allowance should also be made to the Missouri, Kansas & Texas lines for all business which they originate. In prorating with the Missouri Pacific branches these are allowed arbitrary mileage of two for one, which should be allowed to parts of the Missouri, Kansas & Texas also.

In its original construction the Missouri, Kansas & Texas road was built without reference to advantageous transaction of business, but chiefly with reference to land grants. All construction prior to 1886 was made by construction companies who took their pay in bonds at $20,000 per mile and in stock, making large profits.

The operation of the whole Missouri Pacific system as a system is detrimental to the Missouri, Kansas & Texas, and can only be remedied by provision for arbitrary charges together with a stipulated diversion of business at competing points or by the absorption of the leased property into the system. The Missouri, Kansas & Texas would be a dangerous competitor to the Missouri Pacific if separated and at war, while in the event of separation, northern alliances with the Chicago, Burlington & Quincy or Chicago & Alton would be advantageous to both parties. As an offset to the deficiency the Missouri, Kansas & Texas has some valuable assets and also an equity in the adjustment made against it by the Missouri Pacific, arising through losses of operation and division of tonnage and revenue.

The committee consisted of G. Clinton Gardner, T. B. Atkins and W. P. Robinson, with T. L. Greene as Secretary and Auditor.

One fact of unusual interest in the state election of Iowa this fall is that, for the first time, the railroad commissioners will be elected by popular vote. Naturally there has been considerable struggle for the nominations. The Republican State Convention, Aug. 23, nominated two of the present incumbents, Messrs. Spencer Smith and S. T. Campbell. They did not, however, as had been hoped, nominate Mr. P. A. Dey, who is a Democrat, but selected Mr. John Mahin, of the Muscatine *Journal*, instead. The platform commends Governor Larabee for his courage and fidelity in standing for the rights of the people, and says further:

"We declare our firm adherence to the principle of the legislative control of railways and other corporations. Having been created by the Government, they are, of right, subject to such just laws as may be enacted for their control, and must obey the same. We would deal justly with corporations as with individual interest; but we demand that the people shall be fully protected in all directions from corporate rapacity, whether arising from discriminations, combines, railways or other aggregated capital. We commend the general railway legislation of the last Assembly of our state." It is evident that the reaction against over legislation which is sure to come has not yet begun in Iowa. Indeed, it is hardly to be expected yet. The people have not begun to feel the effects in the loss of railroad facilities and in the discouragement of railroad building which will inevitably follow on the present policy of that state.

It appears that railroad legislation will be an element in the state election in Colorado also. The local papers are urging the people to make a particular examination of the record of candidates in this respect and to vote accordingly.

The financial papers of London think it necessary to warn their readers to consider the recent Western legislation in buying American securities. The *Anglo-American Times*, of London, says: "The tendency of this legislation of the West is to drive out foreign capital, and investors should be cautious in all their dealings, ascertaining in what direction the financial institution in which they invest places its funds."

The consequences of the storm of Aug. 18 and 22 were even more severe than appeared at first accounts. We made some notes last week of the effects in Louisiana and the upper Ohio Valley. It appears that trains were delayed on the Mississippi Valley Railroad and on the Queen & Crescent line by obstructions on the track. On the former road an express train happened to be carrying a contractor with a number of laborers, who were found useful in cutting a way through the fallen trees which lay across the track. A train on the latter line was delayed some time rescuing the occupants of two club houses on Lake Pontchartrain. On the Louisville & Nashville the track was seriously obstructed with fallen trees and telegraph poles, and much inconvenience followed from the interruption of the telegraph service along the line. On the Illinois Central washouts were found from about 20 miles out from New Orleans for a considerable distance north. One sleeping car conductor reported that waves on Lake Pontchartrain ran high enough to invade the sleeping cars. In the neighborhood of Mobile, also, somewhat serious washouts occurred. The Pennsylvania road was obliged to send both east and west traffic over the West Penn Division between Pittsburgh and Blairsville. The largest washout was between Larimer and Adaria stations, and near the former a bridge was carried away. The West Penn Division also suffered somewhat. One Pennsylvania official at Pittsburgh is reported to have said that he never knew so much trouble to have been caused by a rainstorm. The Baltimore & Ohio was, as before reported, the greatest sufferer. Through trains were entirely interrupted for nearly 48 hours, and on the Wheeling Division the interruption was much longer. The Chartiers Railroad also suffered from washouts; and it is said that a good deal of damage was done to pipe lines.

But by far the most serious consequence of the storm was the wreck of the false works of the main span of the Covington bridge, an account of which will be found in another column.

Switzerland seems to be moving in the direction of state railroad ownership; but under conditions which seem likely to insure the payment of a pretty high price for the property. The government must give the owners an annuity corresponding to the average net earnings of the next ten years. A careful effort has been made to define exactly what constitutes net earnings; but we imagine that no effort, however careful, can prevent net earnings from being unduly

large under circumstances like this. No railroad man needs to be told how hard it is to decide what items should be charged to current account, and how often this matter is decided wrongly. In ordinary cases, there is a check upon such error, because the temporary gain involves a permanent loss. In the case before us, there is no such check. The less the property is worth when they take it the more the Swiss government will have to pay. If the railroads care to omit to make repairs, or if they can charge those repairs to construction account, their net earnings will appear larger. The government will thus have to pay them more. But the very facts which force them to pay more make the property worth less. If repairs have been omitted the government actually receives less; if they have been charged to construction account the government finds its property loaded with fictitious indebtedness. An instance like this illustrates in the clearest form the opposition between the temporary and the permanent financial interests in a piece of property like a railroad.

The Russian railroads have just held a congress at Moscow to consider the question of wheat rates. In spite of the rigid state supervision, the roads of that country seem to be permitted to make rates on sensible principles. We commend the method adopted to the notice of our railroad men and of the Inter-state Commerce Commission. According to the *Russian Gazette*, they first considered the quantities shipped from the different railroad centres in Russia. In the next place, they considered the conditions which were necessary to enable these various cities to compete in the London market. The tariffs were established with this point constantly in view. A special commission was appointed to study the conditions of sea transportation from the various ports, in order that different rail routes may be treated fairly in this respect. As far as we can judge from the somewhat meagre notice at hand, the Russian roads are doing precisely what Mr. Fish tried to do in 1882. In his careful study on the adjustment of transportation rates to the seaboard, he showed most clearly how the rail rate and the ocean rate are closely connected with one another. It is a pity that the Interstate Commerce Commission should assume that they are two separate things. In this respect the American authorities have something to learn from the Russian.

The Pennsylvania Railroad Co. has brought suit in the United States Circuit Court for $5,210,000 against the Staten Island Rapid Transit Co. and the Baltimore & Ohio, joint builders of the Arthur Kill bridge. The allegations specify that the amount of damage already done by the bridge aggregates $210,000, and that the damage which may be expected to be suffered in the future will amount to $5,000,000 more. It is also alleged that, notwithstanding the apparent legal authority for the construction of the bridge, it is an obstruction to navigation because it has not been built upon approved plans. The complaint further sets forth that three tugs are now necessary to a tow where one formerly answered the purpose; that only two of the complainant's coal barges can go through the bridge abreast, whereas before the bridge was built eight could be lashed together, and that their boats are damaged daily by being dashed against the abutments by the strong tide.

Messrs. Bott and Cousins have, according to *Industries*, made a very valuable improvement in the treatment of steel for casting, which consists in passing molten steel or iron through a bath or filtering medium of a purifying and deoxidizing alloy of less specific gravity than either steel or iron, such bath or filtering medium rising and forming a stratum or film on the surface of the molten steel or iron while in the cupola from which it is subsequently tapped. The filtering medium employed is obtained from aluminous iron ore containing from 10 to 12 per cent. of titanium. It is claimed that the effect of passing the steel as it melts through this deoxidizing layer is to clear it of impurities, especially those of a gaseous character, and the resulting castings are free from honeycombs and blowholes. The steel, even with 1 8 per cent. carbon, can be reduced to the mildest temper by annealing, and is already attracting the attention of English gun makers for its tenacity and ductility.

This procedure seems in effect to be simply making titaniferous steel. Somewhere between 1840 and 1850 McIntyre built a charcoal furnace near a large bed of titaniferous ore in the Adirondacks, near Lake Sanford, about 50 miles north of the terminus of the Adirondack Railroad. The steel made from this iron is said to have taken the first prize over all competitors at the World's Fair of 1851 in London. But titanium, particularly as ilmenite, the form in which it occurs in the Adirondack ores, renders the iron ore very refractory, requiring almost twice as much fuel to reduce it as ordinary ores, and the only limestone available for flux contained titanium. So the iron made was costly. On the death of Mr. McIntyre the works were stopped, and the furnace has gone to ruin. Bringing these ores again into the market would give this country command of a very valuable brand of iron for crucible steel making, and it is possible that mixing the ore with the materials we now have would make an improvement in our open-hearth and Bessemer steels.

The State Geologist of New Jersey announces that the sheets of the magnificent atlas which the geological survey of that state has prepared and published will be sold at the price of 25 cents each, either singly or in lots. This is said to be simply the cost of paper, printing and postage. Nothing finer in the way of topographical maps has been done by any of the state surveys, and a real public service has been rendered in making these sheets available at a price so reasonable.

NEW PUBLICATIONS.

The September *Scribner's* contains the fourth paper of the railroad series. This one is on Passenger Travel, and is by Gen. Horace Porter. The gifts of the author as an entertaining writer and speaker are so widely known that it is hardly necessary to add that in this article the interest of the series is well maintained. The author goes over well-known ground in showing the gradual development of the passenger car of to-day; but in telling about the growth of that class of cars which we owe to Mr. Pullman he is in a comparatively new field. He relates the history of the sleeper, from the crude device used on the Cumberland Valley Railroad in 1836-37 to the splendid vestibuled cars which have come into wide use in the last year. In these, as he truly says, the ordinary passenger travels in "as princely a style as any crowned head in Europe in a royal special train." The ingenuity and enterprise of Mr. Pullman have indeed given to the plain citizen who travels every comfort but one; fresh air they have not given him.

The *American College Manual*, compiled by C. Powell Karr, C. E.; published by William T. Comstock, New York, price 25 cents. It is the design of this pamphlet to present in a very condensed form the courses of study pursued at leading colleges and universities, with the time required to complete the courses, the requirements of admission, cost of tuition, etc., together with other convenient information for those who are undecided what college to enter. The manual will undoubtedly be found to serve a certain purpose in helping the inquirer to eliminate the colleges that he does not wish to go to.

The National Association of General Baggage Agents has issued a report of the meeting held in New York, July 18 containing a list of members, the report of the Secretary and the reports of special committees.

The Association of American Railway Accounting Officers has issued a report of its first annual meeting, held in New York, July 25 and 26. The report contains the Constitution and By-laws and reports of committees, together with the papers presented, which have been reprinted already in the *Railroad Gazette*.

TRADE CATALOGUES.

Messrs. Pedrick & Ayer, of Philadelphia, have issued a catalogue of their numerous well-known special tools for repairing locomotives. The catalogue is well illustrated, and the descriptions of the tools are sufficiently full and explicit to enable their suitability for their purpose to be clearly understood. Many of Messrs. Pedrick & Ayer's special tools have been illustrated and described in the *Railroad Gazette*, and are well-known to our readers. The catalogue, however, contains illustrations of many specialties and improvements, and will be useful to all those in charge of locomotive repair shops.

Haines, Jones & Cadbury, of Philadelphia, have issued their Illustrated Catalogue C, of bath tubs, water closets and plumber's supplies generally. They ask especial attention to new designs of washout closets and hard wood cisterns and sinks. They show various apparatus suitable for shops and large office buildings, and ask for correspondence on matters relating to sanitation and plumbing generally.

TECHNICAL.

Locomotive Building.

The Baldwin Locomotive Works have now delivered six of the 15 passenger locomotives ordered for the Duluth, South Shore & Atlantic. The locomotives weigh 90,000 lbs. and are fitted with 18 × 24 cylinders, extension fronts, straight stacks, 5½ ft driving wheels, and with both the Westinghouse air brake and the American steam driver brake, the Baldwin patent steam turret, the Detroit lubricator, metallic packing, and solid end coupling rods. The fire-boxes are placed 22½ in. above the rail. The Baldwin Works also have under contract 15 freight locomotives for this road.

The Chicago, Burlington & Quincy has nearly completed at its West Burlington, Ia., shops two passenger locomotives for use on the Iowa Division. They are fitted with 63-in. wheel centres, 19×24 cylinders and the Krupp steel tire. The engines weigh 110,500 lbs., with 93,500 lbs. upon the drivers. Five consolidated locomotives are also being built at these shops for the Burlington & Missouri River road. The latter weigh 118,500 lbs., with 102,500 lbs. on the drivers. The locomotives are fitted with the Belpaire firebox.

The Rogers Locomotive Works, at Paterson, N. J., this week completed three new freight locomotives for the Mexican National. A six-wheel freight locomotive was also completed for the Brunswick & Western.

The Cape Fear & Yadkin Valley has just ordered two new locomotives.

The Pittsburgh Locomotive & Car Works, Pittsburgh, Pa., last week delivered one freight locomotive to the Georgia, Carolina & Northern are completing an order for three small locomotives for a Birmingham road.

The Philadelphia & Reading placed in service this week, on its Bound Brook Division, nine new locomotives recently received from the Baldwin Locomotive Works, Philadelphia. The Baldwin works have also recently completed one freight locomotive for the Dayton (Tenn.) Coal & Iron Co.

The Southern Pacific last week received 10 new locomotives.

Car Notes.

A passenger car built after a new pattern was recently completed at the Louisville shops of the Louisville & Nashville for the Southern divisionof that system.

The Mexican Interoceanic has ordered 125 cars of various patterns from J. G. Brill & Co., of Philadelphia, to be delivered before the close of the year. The firm has also received an order for eight passenger cars for a local road at Birmingham, Ala.

The Missouri Car & Foundry Co., of St. Louis, Mo., last week delivered 20 new box cars to the Nashville, Florence & Sheffield.

The Louisville, New Orleans & Texas has received the first installment of the 500 freight cars recently ordered.

The Atlantic & Pacific some time ago ordered 1,000 coal, 200 stock, 200 box and 200 platform, 15 passenger and 25 emigrant cars. Of this order the company has already received 447 coal and platform cars, and the balance of the order is arriving daily.

The last of a lot of 3,500 freight cars, ordered by the Pennsylvania Co. is now being delivered.

The Harlan & Hollingsworth Co., of Wilmington, Del., has delivered three more sleeping cars to the Boston & Albany of the order they are building for that road.

At the car shops of the Central-Hudson Railroad, West Albany, two funeral cars are being constructed. The interior finish is mahogany, richly carved. There is one compartment for the coffin and a larger one for the mourners. These cars are to be used about New York City, and are the first of their kind ever constructed at the Albany shops.

Bridge Notes.

The Palatka Bridge Co. has been organized by R. H. Mason, of Jacksonville, and others, to construct a bridge across the St. John's River, at Palatka, Fla.

The Wrought Iron Bridge Co., of Canton, O., has been awarded the contract for erecting a bridge across the Muskegon River, at Big Rapids, Mich. The contract price is $13,000. There were nine bids received.

Plans of the bridge to be built by the Sorel Railway over the Richelieu River, at Sorel, Que., have been prepared for submission to the Town Council, which is expected to pay part of the cost, which is estimated at $100,000.

Proposals are wanted until Sept. 6 for the construction of an iron superstructure for the bridge at Seneca street, Cleveland, O., by Walter P. Rice, City Engineer.

The Massillon Bridge Co., of Massillon, O., has been awarded the contract to build a bridge at Wellsburg, W. Va., to cost $3,408, and the Champion Bridge Co., of Wilmington, O., a bridge to cost $1,898.

At Oysterville, Wash. Ter., the contract for erecting a bridge over Willapa River has been awarded to the Pacific Bridge Co., of San Francisco, Cal., the only bidders, at $4,874.

The King Iron Bridge Co., of Cleveland, O., has been awarded the contract to build several iron bridges at Harrison County, W. Va. Contract price is $29,000.

The County Commissioners will erect a new iron bridge 300 ft. long across the Little Kanawha River, at Parkersburg, Va.

Plans for the proposed Walnut street bridge at Philadelphia are now being prepared at the Survey Department. The entire length will be about 3,000 ft.

The Central of New Jersey has awarded contracts for building two new bridges on the Newark Branch, and two across streets in Newark, N. J.

Manufacturing and Business.

The Hussey Re-Heater and Steam Plant Improvement Co. is looking about for a site at which to establish a factory for the manufacture of its various appliances for the economy of steam power. The company has heretofore let out its work on contract, but intends now to put up a plant to employ perhaps 50 mechanics.

The Pennsylvania Railroad has contracted with the Brush Electric Light Co. for an incandescent light plant at the new car shops at Pavonia, N. J. The plant is to consist of 5,000 candle power dynamos.

Gould & Eberhardt, of Newark, N. J., recently erected a new drill in the factory of Fisher & Davis, of Chicago.

The buildings of the McElroy Railroad Signal Co., at Canton, O., are now nearly completed and the entire works will soon be removed from their present site at South Boston. The town of Canton has given the company 150 acres of land and voted $40,000 for the establishment of the works at that place.

The Hartford Woven Wire Mattress Co., of Hartford, Conn., has just completed, for a New England road, an order for equipping about 40 passenger cars with its patent seat. The company is now engaged upon several other large orders of a similar character.

The Automatic Car Brake Co., of Bradford, Pa., has been organized with a capital stock of $100,000 by C. P. Cody and others.

The M. C. Bullock Manufacturing Co., of Chicago, report the following recent shipments: To the Joliet Steel Co., Joliet, Ill.; to Wenberg & Co., Joliet, Ill., one Eclipse drill outfit each; to F. Prentice, Ashland, Wis., three heavy power derricks; to Lillie & Munson, Fort Wayne, Ind., one double cylinder portable hoist; to the Minnesota Iron Co., Tower, Minn., 1 Beauty diamond drill.

The Massac Iron Co., of Metropolis, has been incorporated with a capital of $40,000, by W. R. Brown, James M. Choat and W. O. Towle.

The American Filter Co., of Chicago, has recently completed a filter plant with a daily capacity of 500,000 gallons, for the Joliet Steel Co., of Joliet, Ill., and have a contract for a second order for the same firm.

The American Live Stock Express Co. of New York, this week started a train of 18 cars for Soda Springs, Idaho. The company has a contract for the transportation of cattle from that place to the Atlantic seaboard. This train is equipped with 42-in. steel-tired wheels, Lorraine couplers, Westinghouse air brakes, and it also has a buffet car attached for the accommodation of the company's employés who have charge of feeding and watering the stock while in transit. This train will be under the special charge of Benj. F. Holmes, the General Manager of the company. Other trains will follow this one within a short time.

The 300 coal cars which are to be built by the Barney & Smith Manufacturing Co., Dayton, O., for the Kansas City, Fort Scott & Memphis, will be inspected by the Robert W. Hunt & Co. bureau of inspection and tests, of Chicago, Ill. This firm has also the inspection of 400 axles to be made by the Straight Fibre Iron Co., of Chicago, for the Kansas City Car & Wheel Co., and also for 100 coal cars now building for the Kansas City, Fort Scott & Memphis.

The Duluth, South Shore & Atlantic has ordered a rotary steam snow shovel for use on its line.

Iron and Steel.

The Troy Steel & Iron Co., of Troy, N. Y., has put in new boilers at the steel mill, and intend to run one-half the boilers with coal and one-half with oil as fuel.

The Conley Iron & Steel Co., of Chicago, has been incorporated, with a capital stock of $1,750,000, by Arnold Brecher, Laing Leland and others.

The Navy Department has invited proposals for the construction of one steel submarine torpedo boat, complete, with torpedo fittings and appendages. The vessel is to be constructed within the United States and of material of domestic manufacture. Bids will be received until Jan. 4, 1889.

Mr. James P. Witherow, engineer and contractor, of Pittsburgh, Pa., whose works are at New Castle, has received a contract for the erection of three blast-furnaces for the De Bardeleben Coal & Iron Co., of Birmingham, Ala. The fur-

naces will be built at Bessemer, about four miles from Birmingham.

The Halifax Iron & Steel Manufacturing Co., of Halifax, N. S., has been incorporated, with a capital stock of $700,000, for the purpose of manufacturing iron and steel.

The Lawrence Furnace Co., of Ironton, O., intend to build a 30-ton coke furnace near their present idle furnace at Culbertson.

The Lackawanna Iron & Coal Co., of Scranton, Pa., has been reorganized as the Lackawanna Iron & Steel Co., and the capital stock has been increased from $1,000,000 to $3,000,000.

Warren Wood & Co., of New York, report an increased demand for all grades of Southern pig iron at a slight advance on former prices. During the past few days they have received orders for several large lots for immediate delivery.

The Carbon Iron Co., of Pittsburgh, has finished an open-hearth steel plant consisting of two 15-ton furnaces, and is now making steel. The company is also putting in a large universal mill that will be completed and in operation about Sept. 1, after which time it can furnish universal rolled plates, steel, up to 36 in. wide, and of any length or thickness required for structural purposes; also open-hearth steel slabs from 6 in. to 30 in. wide, and from 2 in. to 6 in. thick, and blooms from 4 in. to 8 in. square.

The Rail Market.

Steel Rails.—The only transactions reported are orders for 5,000 tons for a coal road and 1,200 tons for a line in Florida. The principal inquiry is from the promoters and contractors of Southern roads, but bonds are generally offered as collateral for personal notes, so that the mills but seldom accept the orders. Quotations are $28.50@$29 at Eastern mills.

Old Rails.—Small sales have been made at Buffalo at about $23, and at Youngstown at $24. Most of the New England mills are holding at $24 and $25.

Track Fastenings.—Spikes are quoted active at 2.10c. and angle bars firm at 1.90c.

The "Baltimore."

The new twin-screw steel protected cruiser "Baltimore" will be launched from the shipyard of the William Cramp & Sons' Company on the 28th or 30th inst. The "Baltimore" was built after the designs of Mr. W. H. White, the chief constructor of the English Navy, while her engines and machinery in general are constructed after the plans of Humphrey & Tennant, of England.

The principal dimensions are as follows:

Length between perpendiculars	310 ft.
Beam	48 ft. 6 in.
Load draft, mean	19 ft 6 in.
Load displacement	4,400 tons
Indicated horse-power, natural draft	7,500
Indicated horse-power, forced draft	10,750
Maximum speed per hour, forced draft	19 knots
Cylinders, dia. and stroke	42, 60 and 94 × 42
Screws, three-bladed, dia.	14 ft. 6 in.
Boilers, No. and dia., four	14 ft. 8 in.
Furnaces (corrugated) No. and dia., 32	3 ft.

The stem, stern post, and rudder post are steel castings made by the Standard Steel Co. of Chester, Pa. The rudder and steam-steering gear are placed below the water line, under the protection deck, worked from the chart house and conning tower, so that, in case a shot should strike the cruiser above the water-line, the steering gear of the vessel would escape uninjured. The Baltimore's masts are to be fitted with lower yards, to be used chiefly for signal purposes. A large military top, with bullet-proof armor, will be erected on each masthead, and in these Hotchkiss revolving cannon, or long-range, single barrel guns will be mounted.

Two electric plants of the most approved pattern, the lightest and most compact and best adapted for marine work, are used. Each engine is so arranged as to drive either dynamo separately or both together. The dynamos are each of 3,200 candle-power, so constituted that lights of 10, 16, 32 and 50 candle-power can be used on the same circuit, with an independent control over each lamp. All parts of the ship will be fully lighted by the incandescent lamps, including coal bunkers, magazines, shell and ammunition rooms.

Natural ventillation is used as much as possible for the living and storage spaces, by means of pipes, louvres and cowls. Artificial ventilation is also provided for all compartments below the living deck by means of two blowers of 10,000 cub. ft. capacity per minute, so arranged with reversible valves as to exhaust from or force air to the several parts of the vessel, and to deliver it into the lower parts of the engine room or the open air.

A steam bilge-pump has been placed in each engine room, with suctions from the sea, the engine room bilge, the ship's drainage system and the boilers, each delivering into the fire main or overboard. The steam windlass, which is fitted on the forward gun deck, is worked by an independent engine, fitted with warping ends on each side for taking hawsers, to be worked by hand power when required.

The main battery will consist of four 8-in. breechloading rifles, mounted on the poop and forecastle decks, 26½ and 28 ft. respectively above the water. Besides these there will be six 6-in. breechloading rifles, mounted 18 ft. above the water in sponsons, having a train of 155 deg. from the line of the keel for the forward and after pairs, and a train of 130 deg. for the guns in the waist.

The secondary battery consists of six 6-pounder rapid-fire guns, 6 Hotchkiss revolving cannon and 4 Gatlings. Five above-water lauching tubes or guns are fitted, two fixed tubes forward, firing directly ahead, and one fixed aft, with a training tube on each bow. An armored conning tower, 3 in. thick, is being fitted on the forecastle, with a horizontal cover 1 in. thick, with opening in the sides for outlooks. Within this tower are to be engine telegraphs, a steering-wheel, an indicator and speaking tubes.

Paris and Constantinople.

The new all-rail route from Paris to Constantinople is just completed via Zaribrod, Sofia and Vakarel and runs through some of the most charming scenery in Europe. Soon after leaving Nisch it enters the Nicbava Pass and is carried for about 10 miles along a mountain side, with a torrent falling 200 ft. below and perpendicular rocks towering 300 ft. above the track, a delightful place for brigands. The train crosses the Servian frontier 8 miles beyond Pirot, from which place it speeds through a peacefully level plain to Zaribrod. A little beyond Zaribrod comes the gloomy Dragoman Pass and then Slivnitza. From this point the road is level again, and the White Konak, or Palace of Sofia, can be seen gleaming on an eminence, with the two minarets which remain as mementoes of Ottoman rule, for miles before the capital is reached. From Sofia the scenery again offers a beautiful prospect of hills, woods, rivers, and valleys up to Ichtiman. Thence the road is mountainous as far as Bazardjik, where it descends into the plain again until one comes in sight of Philippopolis, which is superbly situated on slopes overlooking the Maritza. This river winds along near the track of the railway, appearing again and again up to Mustapha Pasha, where it forms the Turkish boundary. Adrianople lies two hours beyond this, and is 143 miles from Constantinople as the crow flies. But until lately it took trains twelve hours to crawl over this distance. Passengers are now promised a higher rate of speed, and it is affirmed that the journey from London to Constantinople will be accomplished in four days and a half.—*Engineer* (London).

Self-weighing Freight Cars.

M. Th. Chavanis, an engineer of Paris, has designed a weighing apparatus intended to be a permanent attachment to freight cars, so that the weight of the load may at all times be ascertained by a glance at a dial. An illustrated description of this apparatus has lately been given in the *Annales Industrielles.* The inventor utilizes the deflection of the springs to indicate the weight carried, and this idea (which, by the way, is not new) could be carried into practice by simply attaching a pointer to each axle box playing over a scale fixed to the frame. By adding the readings of all the springs the total weight can be found; but this arrangement is open to two objections. In the first place, a person would have to round the car to take the readings; and in the second place, the degree of accuracy attainable would be very small. To remedy these defects, M. Chavanis joins the four axle boxes of a four-wheeled car by a light iron frame, which carries midway between the two axles and parallel with them a spindle provided with a pointer on each end. In the middle of this spindle is fastened a counterweighted lever, against the end of which presses the lower end of a pin fixed vertically to the floor. Any depression of the floor causes thus a rotation of the indicating spindle, which is made visible by a long pointer playing over a graduated scale on either side of the car. During travel the counterweight is thrown over, bringing the lever out of contact with the vertical pin, so that the apparatus may not be subjected to the jar and jolting of the road. By means of a single vertical screw adjustment of the bearings of the indicating spindle, the pointers can be brought to zero when the car is empty, and even if its springs should have in course of time suffered a permanent deformation.

The apparatus as above described is applicable only to four-wheeled cars, but there seems little difficulty in adapting the details to eight-wheeled cars.

The Westinghouse Quick Acting Brake.

The improved quick acting Westinghouse triple valve has been fitted to many of the Pennsylvania passenger cars. The engineer's brake valve is marked with the positions in which the handle should be placed for an ordinary and an emergency stop.

The Hall Car Coupler.

It is stated that the Hall automatic freight car coupler is being placed on some cars building for the Cincinnati, Cleveland & Sandusky.

Providence Terminals.

On Aug. 23d the joint special committee on terminal facilities opened the bids for filling in the big cove basin. The basin, which is a mile in circumference, is to have a stone channel built, and 300,000 cubic yards of dirt are to be dumped on either side of the wall. J. J. Newman, of Providence, secured the contract for the walls, and is to begin the job about Sept. 15, and finish it not later than Nov. 1, 1889. The contract for the filling has not yet been awarded, but it is understood that the New York & New England and the Providence & Springfield railroad companies are among the competitors for the job.

Large Mileage of a Locomotive.

A passenger locomotive on the Columbus & Cincinnati Midland, No. 4, built by the Schenectady Locomotive Works, was put into service Sept. 9, 1884, and worked continuously until Jan. 20, 1888, when she broke a parallel rod and both back pins. If this accident had not occurred the engine would have continued in service some time longer, there being nothing absolutely needed in the way of repairs, except turning off the tires. It was probably the "flange on both sides" of the tire that caused her to catch on a curve and twist her pins off. During this time her mileage was 185,483 miles, not including mileage at terminal stations, to and from the depots and round-house. The engine had never been laid up for repairs during that time, had no flues removed, nor been off her wheels at all, had in fact been in constant service with nothing but the simple ordinary repairs necessary at the end of each trip.

A Uniform Standard Builder's Contract.

After a good deal of labor, a joint committee of the American Institute of Architects of the Western Association of Architects and of the National Association of Builders has agreed upon a standard form of builders' contract, which has been adopted by those three bodies. The object sought to be obtained by the committee was to prepare a form of contract which could be received and adopted generally by architects and builders as a standard form, and in which the several provisions necessary to constitute an equitable agreement, as between the owner and the builder, would be incorporated. In order to preserve the form from errors, alterations or interpolations, it has been copyrighted. It is the general intention of the members of the National Association of Builders to have it understood that in all cases where proposals for any work are submitted by them, such proposals are made with the understanding that the contract made upon this standard form is the one that is to be executed by them upon such proposals. The Inland Publishing Co., 19 *Tribune* Building, Chicago, Ill., has been licensed to publish the blanks, and any number of copies, with prices, etc., can be obtained from them on application.

Friction Gear.

At the Dublin meeting of the Institution of Mechanical Engineers Mr. John Purser Griffith read a paper describing the friction gear used on a double steam dredger. As originally constructed grooved pinions keyed on the engine shaft geared with grooved driving wheels on an intermediate shaft. These driving wheels were loose on the shaft, but were connected to spurred pinions keyed on the intermediate shaft and actuating the buckets of the dredge. The grooved driving wheels revolved on eccentric bushings, so that by means of levers they could be thrown into gear with or disconnected from the grooved pinions on the engine shaft. The diameter of the grooved pinions was 54 in., of the grooved driving wheels 127½ in., and there were nine grooves in each wheel, at an angle of 40 degrees, and 1¾ in. pitch. The speed of the grooved wheels at their circumference was 500 ft. per minute, and each pinion was designed to transmit about half the effect of an engine indicating 150 horse-power. Although the device was operative and reasonably effective, it developed numerous defects, such as unequal wear in the different grooves, springing of the rims to such an extent as to break some of the grooves, and at times requiring so much force to gear and ungear as to be dangerous to the operator. In the course of 12 years the large grooved wheels were about worn out, and the pinions had been twice renewed and also re-turned. At the end of this time a new arrangement was fitted. The friction wheels were removed and toothed gearing was put in their place, the driving wheel being loose on the intermediate shaft, but connected to a toothed pinion keyed on that shaft, as before. A brake-wheel was bolted to the side of the toothed driving wheel on the intermediate shaft, and steel bands were arranged to act as brake-straps, when set up by a hand-wheel and screw, thus putting the intermediate shaft in motion and actuating the buckets of the dredge.

This arrangement was more efficient than the original device, since there was less slipping and 14 buckets were emptied per minute instead of 12 in the former case. It is stated that the consumption of coal was also less with the new device.

In the discussion which followed the reading of this paper, it was pointed out that the slow speed of the friction wheels (about 8.3 ft. per second) was sufficient to account for the defects of the original arrangement, and most of the speakers agreed that the wheels of a frictional driving device, to be effective, should have a circumferential velocity of at least 30 ft. a second.

Parsons' Compound Steam Turbine.

A paper read by Mr. Charles A. Parsons, at the Dublin meeting of the Institution of Mechanical Engineers, entitled "Description of the Compound Steam Turbine and Turbo-Electric Generator," called forth the remark from Mr. Davey, one of the members, that "they had before them what might be regarded as the first successful real rotary steam engine. They had had rotary steam engines *ad nauseam*, but they had all been reciprocating engines with reciprocating parts simply concealed."

If the statements in the paper are to be credited the remark quoted above is fully justified.

As first constructed, a Jonval turbine actuated by steam was connected directly to a dynamo. The first machine was run at 18,000 revolutions per minute, and developed 6 electrical horse-power. A second was built to furnish power for 60 incandescent lamps, and was run at 10,000 revolutions a minute. A number of others were built, and have been running from 2 to 4 years about as economically as a plain slide-valve reciprocating engine.

Desiring to realize greater economy, this engine was compounded, the turbines being arranged in pairs, on the same spindle, one behind the other. They were placed in pairs, and the steam admitted centrally, so as to produce a balance; but since absolute balance is not attainable, the bearings have a little side play controlled by springs. The steam passed from the first turbine to the second, and so on, the successive turbines being designed so as to give the same velocity of flow. The most economical design yet constructed was a triple-expansion turbine, consisting of two series of three turbines each.

Careful tests, checked by repetition, show that the consumption of steam hourly per electrical horse-power with this engine was

42 pounds for an initial pressure of ..... 61 lbs. per sq. in.
35.1 " " " " ..... 92 " "

The weight of the whole plant, engine and dynamo, is about 73 lbs. per electrical horse-power.

Military Portable Railroads.

American makers of portable railroads will be interested to know that a section of such structure has been brought to Montreal from France for experiment. It is in lengths of 20 ft., with switches, curved rails, etc. The design has been adopted by the French ministry of war. If, now that the fisheries treaty is rejected, Canada is preparing material of war in contemplation of possible trouble with the United States, our manufacturers ought to sell her the railroad material at least.

Milwaukee Flushing Tunnel.

The Milwaukee flushing tunnel will be in operation about the middle of September. The object of this tunnel is to turn a current of water from the lake through the river for the purpose of purifying the water of the river, in order to get rid of the bad odor and, possibly, disease germs. It is expected that about 245,000 gallons of lake water will pass through the tunnel every minute, and the good results from the project are expected to come from the effect of this lake water in lowering the temperature of the river water and checking fermentation. The difference in temperature of the river and lake water is about 15 degrees. The tunnel will have cost $250,000.

English Canals.

On behalf of the Birmingham Chamber of Commerce the following notice of motion has been given for the coming Cardiff meeting of the Associated Chambers: "That having regard to the continuous development of canal construction in Germany, France, Belgium and Holland, and to the importance of this question if England is to maintain her manufacturing and commercial position, a deputation representing this association be appointed to wait upon the President of the Board of Trade, urging him without delay to promote legislation for the improvement and extension of canal navigation within the United Kingdom."

A Fast Run on the Panhandle.

The train sheets show that on Aug. 17 Engine 340, on the Chicago, St. Louis & Pittsburg (Panhandle route), Mike Greenan, engineer, made what is claimed to be the fastest run—hauling the "Pennsylvania Special," No. 20—ever made on the Pennsylvania lines west of Pittsburgh. The train, which consisted of four cars, was hauled from Indianapolis to Bradford, 105 miles, in 121 minutes, after making an allowance for making two stops at railroad stations, one of four minutes, stopping at five railroad crossings, and slowing down running through Greenfield, Knightstown and New Paris. The train, which left Indianapolis 37 minutes late, ran into Columbus but 5 minutes late. The actual time, including stops was, therefore, 2 hours, 13 minutes, giving a speed of 47.4 miles per hour, while the average speed whilst in motion was 52 miles per hour. The schedule time is 2 hours 45 minutes, with two intermediate station stops. This gives a speed of 38.2 miles per hour, including stops.

This train, the "Pennsylvania Special," a through train from St. Louis to New York, is scheduled to run from Indianapolis to Columbus, 188 miles, in 5 hours, making stops at six intermediate stations. This gives a speed of 37.6 miles per hour, including stopages. This exceeds the average speed of the train on the main line of the Pennsylvania, 33.7 miles per hour, or the average speed over the whole distance, 34.5 miles per hour.

Influence of Aluminum on Cast Iron.

Mr. W. J. Keep, C. E., Superintendent of the Michigan Stove Co., of Detroit, read a paper before the American Association for the Advancement of Science on "The Influence of Aluminum upon Cast Iron." He showed that aluminum caused white iron to turn gray; that it entirely prevented blow-holes, increased the strength, took away all tendency to chill, lessened the thickness of scale, softened the iron, increased its elasticity, reduced permanent set and with white iron increased its fluidity. Aluminum reduces shrinkage by its sudden changing of combined carbon to graphite. Owing to the rapidly falling price of aluminum the results of this original research will be of great value to the iron founder.

Mr. Keep also showed that even as small an admixture as 0.25 per cent. of aluminum has an important influence, and that the alloy of iron and aluminum is permanent and is not disturbed by repeated remelting.

THE SCRAP HEAP.

Curiosities of Patent Literature.

Patents are often applied for or taken out for very curious inventions, but in the old days of the English patent law there were many very curious specifications which are now extinct, owing to greater care in supervising claims and statements and weeding out superfluities than was formerly brought to bear. In looking over some old papers the writer recently came across an old printed specification which had been duly and properly issued by the English Patent Office, and which is very curious indeed. It bears date A. D. 1860, 1st August, No. 1,861, and is for a patent for purifying and cooling water and atmospheric air. This patent was granted to one Joshua Jackson, of Wolverhampton, and it would appear that the Government Department have printed it in Joshua's own spelling and grammatical construction, or rather destruction, for the following, amongst others, misspellings are noticeable, "gasseous," "cyphon," "gasses," "scope" (for scoop), "downny," "leaver," "experitmented."

After very fully describing his invention, a charcoal filter, down to minute details, Joshua next proceeds to "state as briefly as I can what I know as to the novelty of my invention as hereinbefore specified." We do not know that Joshua still breathes. Perchance he has gone where water filters are not required. We dare not make inquiries at No. 29 Queen street, Wolverhampton, lest peradventure Betsy Jebb might confront us, or even brother Sampson, but we will simply content ourselves with a faithful transcription of lines 28 to 39 of page 12 of Joshua's specification and lines 1 to 3 of page 13. Briefly then Joshua thus unbosoms himself:

"I first became aware of the purifying qualities of charcoal some twenty years ago in the course of my readings and practice as an operative chemist, but it never occurred to me to apply it to the purification of water until the early part of last summer, when I at once gave my whole soul to the subject, and have continued incessantly to pursue it with all my energy during eight months, strengthened by the hearty and efficient co-operation of my dear wife, the support of our Brother Sampson, the enthusiastic admiration of our dear friend Mr. Robert Noyes, and our brother-in-law Mr. William Neeld, the cheerful assistance of our several women, particularly Martha Heath and Betsy Jebbs, and the warm smile of an enchanted public, particularly the dear little ones, who clasp the cold sparkling crystal with both their tiny hands and lifted to their sweet little quivering lips.

"To some this may be seem *irrevelant*, but I feel it a tribute of justice which gives me inexpressible pleasure to render, for without such aids it would have been a physical impossibility for me to have brought my invention to a successful issue."

This is inexpressibly touching and pathetic. We feel a desire for further information as to the special assistance of Betsy, while we seem to see the beaming smiles of admiring Robert. Doubtless the hard labor of the invention was done by Bro. Sampson. We wonder where all these good people now are. Joshua himself must be at least 70. Why was not Mr. William Neeld's mother included in the list of co-adjutors? Can it be that she and Joshua were not friendly? The document is unmistakably genuine, and bears the impress of the Queen's Most Excellent Majesty's printers, Eyre & Spottiswoode.

This curious specification even reached a second edition, for so this is marked. Probably it was discerned as a curious piece of work, and sold well accordingly.

Photographs on Tickets.

A young man in Atlanta has filed a claim for a patent on the use of photography for preventing the transfer of round trip or other reduced rate tickets. He proposes to take a photograph of the purchaser, and paste it on the corner of the ticket. Some time ago a plan was submitted for a mileage ticket for the use of the German state roads in which the photograph of the purchaser was to be inserted. The same device was used with season tickets at the Paris exposition of 1878.

For a Yellow Fever Victim.

A circular has been issued by the Traveling Passenger Agents' Association asking for a subscription from the members for the benefit of the widow of Mr. Lucius R. Tuttle, who died of yellow fever at Jacksonsville, Fla., on the 10th inst. The Association has no form of insurance, and can only help the families of its members in such cases by voluntary subscriptions. Contributions can be sent to C. E. Harmon, General Western Agent Georgia Associated Lines, 131 Vine street, Cincinnati, O.

A Good Job.

A new switch connecting John Smith's coal yard with the —— Railroad was tried on Thursday. The locomotive and coal cars went off the track into a goose pasture. The wrecking car was shunted down the switch and that went off. The switch engine went after the wrecker, and followed suit. The trouble was that the curve leading to the switch had been made too sharp.

The Wason Cars in Portugal.

The Wason Car Manufacturing Co., of Springfield, Mass., has just received an order for a passenger car for the Royal Railroad of Portugal, to be finished and shipped with the drawing-room car which the company has nearly completed for the same road. The passenger car will be modeled after the cars which the company has built for the Boston & Albany, and will have the turtle-back roof, large windows, high-back seats and heavy finish, which has made the cars so comfortable. The drawing-room car will be similar to the coaches built for the government road in Chili. The finish will be mahogany, elaborately carved and richly upholstered. The company is also building an hotel car, and is completing several large orders for passenger and freight cars.

Conscience Money.

A few days ago the Superintendent of the Central of New Jersey received a letter which is worth framing. The writer did not sign his name, but inclosed a $5 bill, stating that over 20 years ago, when a boy, he had stolen two rides on freight trains from Perth Amboy to Elizabethport. As he was anxious to clear his conscience of the crime he forwarded $5 for the rides, allowing interest for the lapse of time.

Steel Ties in Burmah.

Steel ties, after having undergone a careful test for the past four years, on different parts of the line, are now displacing the teak railroad ties hitherto used on the open line of the State Railway. Teak so far has been found the best timber yet used for this purpose, and has been found to last as long as 10 years; but the use of steel ties economizes the expense of spikes, and is reported to last from 40 to 50 years. The low price now ruling has been a great inducement not only of substituting steel ties, but also a large quantity of steel rails is now being used in this Province.—*Indian Engineering.*

Strike.

A strike of enginemen, firemen and switchmen took place, Aug. 26, on the Evansville & Terre Haute, the Peoria, Decatur & Evansville, and the Evansville & Indianapolis. The trouble was over the unpopularity of Master Mechanic Smith, of the P., D. & E. Chiefs Arthur and Sargent are said to have consented to the strike. President Mackey stated that no man who struck would ever again be given work so long as he had control of the system. The strike was arranged, and the men returned to work the next day on a promise that the charges against the Master Mechanic should be investigated.

Why the Train was Late.

The train from Peoria was late at Putnam this morning. Putnam is the place to get off the cars and into a spring-wagon for Senachwine Lake. The train had to be late. Just as conductor Johnson looked at his big silver watch and moved his hand without any fingers at the engineer, an old colored lady appeared at the station door and bobbed her bonnet. She was bound for Albany, N. Y., *via* Chicago. She wanted to buy a ticket. The fare was $18. She had $16 in her hand, but she had at least $15 more in her inside pocket, and there was no room about the station sufficiently private for her retirement while she procured it. The station agent escorted her to the coal cellar and left her. Five minutes passed and the engine blew off steam. Then the old lady appeared with her green velvet dress dragging two feet on the ground. In her right hand she held two silver dollars. Her left hand clutched the meandering boundaries of the bosom of her dress. The ticket agent took her two dollars, the conductor took her and clothes aboard the train, and away we went. Twenty miles up the road the lady had completed her toilet, with every cent of her money on the inside. If she buys anything between Peoria and Albany she will have to undress to pay for it. Of course this has very little to do with the meeting of the State Grange at Senachwine Lake, but it explains why the train was late at Putnam.—*Chicago News.*

Interfering with the Rights of the Citizen.

J. M. McConniff, of the Burlington & Missouri, has ordered placards bearing the following legend nailed to the various bridges along the line: "Parties using this bridge for lynching purposes will be considered as trespassers and prosecuted to the fullest extent of the law."—*Nebraska State Journal.*

Done Lef'.

In Austin it is impossible to ascertain when any particular train leaves, without going to the depot and inquiring of the agent how many hours behind time the train is. Col. Yerger wished to go to San Antonio on the eleven o'clock train, so he said to his colored servant: "Sam, go down to the depot, and see what time the eleven o'clock train leaves." It was about three o'clock when Sam returned. "Well, when does the train leave?" "Hit's done lef', boss. Hit left at ha'f pas' two, sah." "What!" "I did jess whut yer tole me. Yer tole me ter see when de train lef, an' I watched till it was plain outer sight on de udder side ob de Colorado Ribber."—*Texas Siftings.*

The "Vested Rights" of Locality.

It is of great importance to a healthy growth in prosperity of any state that its products of the soil or of manufacture should reach consumers at the least possible expense of time or money, and that return commodities should in like manner be transported to them from points of origin. If we admit that particular trade belongs of right to particular places we endanger this other right to general prosperity. It is a fact, too, that cities generally do not need special transportation favors to secure and retain a fair trade. The advantages of neighborhood are of themselves decidedly great. Quick delivery of goods sold and quick returns for produce consigned, a more intimate friendship between buyer and seller than is possible when these are widely separated, these and other points will be readily appreciated, and small disadvantages in freight rates are not enough to overcome them.—*Iron Age.*

An English View of American Railroads.

In a discussion at the recent meeting of the Institution of Mechanical Engineers (British), at Dublin, a Mr. Dobson spoke as follows about American railroads. He seems to have applied his observations of some minor prairie road to the whole American system, but he got a glimmering of the truth, and no doubt he astonished his hearers. Mr. Dobson said that he was reminded, from a recent visit to America, that a railway could be constructed, if it were carried out on the same principles of construction as obtained in America, for very considerably less money than was spent in this country. The great cost of railways here, apart from the land, was the heavy rail, the very good metalling and the thorough drainage of every portion of the construction. In America that was entirely neglected; the rails were very light, and were placed on sleepers much further apart than they were here, and there was no ballasting whatever. They simply raked a little earth round the sleeper and left it there. He had seen tremendous engines, going at a very fair speed, where, according to the eye, there must have been a difference of level between the first bogie wheels and the trailing wheels of at least 2 in., and the way in which the rails played about and the sleepers moved in the earth was simply marvelous to behold. Why the engines stayed on the line he did not know, but they did. Our engines and carriages could not stay on for five minutes, but the Americans were able by that system to extend their railways very much more readily than we could do. Their first cost was very much less, but when they got a traffic that would compare with the traffic obtained in England, they were obliged naturally to put in steel rails and proper ballasting, and that they were now doing. He really thought, however, that too much money was spent in making railways in accordance with certain requirements of the Board of Trade.

The Railroads of Ceylon.

The total number of miles of railroad in Ceylon is but 182, and they have only been in operation 15 years. It seems, from consular reports, that it cost about $150,000 a mile to build much of this road. The country is so mountainous that a great deal of rock work and tunneling is required. The cheapest line cost $99,020 per mile, while some of it cost as much as $175,000 a mile the entire length. The stations are about 6 miles apart on the main line from Colombo to Nanuoya. It seems that these roads, although they charge 5 cents a mile for first-class passenger fare, pay only 3 per cent. on the capital invested. The gauge is 4 ft. 8½ in. Goods on these lines are divided into three classes and are charged accordingly. There are also special rates for certain products—coffee, cinchona, tea, etc.—mostly the products of plantations belonging to Europeans. The country is rich in undeveloped products, but is financially poor.

British Railroads in 1887.

The usual Board of Trade compilation shows the total miles at the close of 1887 to be 19 578, including double and single, meaning an increase of 240 miles during the year. About £10,000,000 was tacked on to the authorized capital during the year, bringing it up to £951,000,000, of which £845,971,654 was paid up. The capital liability per mile open now stands at £43,210 ($209,136), the highest figure on record, and £400 more than in the previous year. The receipts per train mile were the same (4s. 10d.) for the past three years, against 5s. 8d. received in 1874. The ratio of working expenses still shows at 52, against 55 reached in 1874. The net receipts per cent. on paid up capital last year reached 4, against 3.99 in 1886, and 4.74 reached in 1872. It is not very pleasant, too, to have to note that £45,891,000 of ordinary capital last year yielded no return whatever, against £43,510,000 in the previous year. The public, of course, get the benefit of this publicly expended money, but the fact seems to be sedulously kept out of sight on the many occasions when "railway monopolists" come in for abuse.—*Herapath's.*

Early Railroad Ticket.

One of the first railway tickets was printed on a thin piece of pink paper, 4½ in. long and 1½ in. wide, thus worded:

LIVERPOOL TO MANCHESTER.

No 52 12 Sep 1832

at 2 o'clock from Railway Station

Paid 5s. 6d. JH. Agent

N.B.—When seated, be pleased to hold this ticket in your hand till called for. (Turn over)

On the other side:

NOTICE.—No gratuity allowed to be taken by any Guard, Porter, or other servant of the Company.

Smoking in the First Class Carriages is strictly prohibited.

The number of the ticket and signature of agent are in manuscript; the day and month are impressed by a separate stamp. As the first valve gear was invented by an idle boy, who disliked the hard work of pulling by hand the strings and cords which operated the plugs, admitting steam to the cylinders of the early engines of Savory and Newcomer, so the first ticket printing machine numbering them consecutively was invented by a ticket-seller or booking clerk, who disliked the labor of filling in the number, date, etc., by hand. His invention, the Edmundson machine, is still in very general use throughout the world.

The Sagacious Tramp.

The peach growers of Delaware report a great over-plus of tramps. At one point the jail has been filled and still the tramps come in. The railroads arrest all the men against whom they can prove theft, or other crime. At one town on a recent evening 200 tramps were hanging around the railroad station. It is suggested that a special train will have to be run to carry the vagabonds out of the city. If they were to be loaded into dining cars and should see the difference in value of peaches as reckoned there, or even in ordinary cars by the train peddler, as compared with the value in the orchards where they have been regaling themselves, they would doubtless be completely paralyzed, or at least stunned sufficiently to render them harmless for this year at least.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulations of Railroads.

The Supreme Court of Nebraska decide that the state statutes authorize the consolidation of two lines of road or the leasing of a railroad constructed by another road only in cases where the two roads will form a continuous line, without breakage of gauge or interruption. In this case the Atchison & Nebraska Railroad, extending from Atchison, Kan., to Lincoln, Neb., was completed to Lincoln in 1871, and leased to the B. & M. Railroad in 1880. The Supreme Court hold that it did not form a continuous line with the B. & M. Railroad, and was not within the provisions of the statute authorizing the making of a lease, and that such lease was unauthorized; that where a railroad, without authority of law, leases its road to another, it abandons the operation of the road and is subject to forfeiture: that in the section of the constitution forbidding the consolidation of parallel and competing railroads, the word "consolidate" means join or unite; that one of the objects of the provision of the constitution of the state prohibiting the issuing by a railroad of stocks or bonds, except for the consideration actually received, is to enable the public to ascertain the actual cost of each railroad in the state, and to enable the legislature to pass laws fixing an equitable rate of taxation, and for the transportation of persons and property.[1]

In Iowa it is held that a city ordinance which confers upon a corporation power to construct street car lines, and provides that "such tracks shall be operated with animal power only," and that the city shall not, until after 30 years, "confer upon any person or corporation any privileges which will impair or destroy the rights and privileges herein granted," does not preclude the city from granting another company the right to operate lines by other means than animal power.[2]

In Georgia the Supreme Court rule that possession of a railroad company and its successors, under a grant of the right of way for construction and operation, dates from the commencement of construction, and not merely from completion and the running of trains.[3]

In Louisiana in a deed of sale of land to a railroad was the stipulation that the vendee or his assigns "shall build and keep in repair such bridges as may be necessary over the lands herein acquired." The Federal Court in that state rules that this stipulation was too indefinite to be the subject of a bill and decree for specific performance.[4]

In Michigan the Federal Court holds that in an action against a railroad corporation of another state, service of process cannot be made upon a passenger agent whose sole duty it is to solicit travel for the defendant road, notwithstanding he may have been employed to effect a compromise of plaintiff's claim.[5]

In Missouri the property of the defendant, a railroad company, was made up of the consolidation of a number of lines, some of which were taken by purchase and some by lease. Nearly all of these lines were subject to prior mortgages, and there was also two general mortgages on the consolidated system. Defendant filed a bill confessing insolvency, and asking the appointment of receivers to administer its assets among its creditors. The lessor companies were made defendants, and an order was made appointing receivers to operate the entire system. It was also provided that any lessor might at any time assert his right to possession of lines leased by him for unpaid rent. The United Circuit Court decides that the taking possession of leased lines by the receivers did not make them assignees of the leases, so as to make the rentals due under such leases prior to the mortgages. In the same case on the petition of the receivers showing that one branch of the system had earned more than operating expenses, an order was made that out of the profits of that branch the rental thereon be paid, until otherwise directed. The Court holds that the lessor had a right to rely on this order, and the receivers would be required to pay the rental from the time specified.[6]

In Missouri the Federal Circuit Court rules that where a contract between two railroad companies operating a joint line does not expressly provide how cars shall be obtained or supplied for the use of the line, the fact that one company for several years after the contract was entered into paid the other for the use of its cars will be considered as a con-

struction placed on the contract by the parties, and the courts will enforce such payment as a part of the contract.[7]

In Illinois where a railroad was sued by a wrong name, the plaintiff believing that the name on its cars, etc., was its real corporate name, the Superior Court holds where the real party in interest, and the one intended to be served, is actually served with process in the cause, even though under a wrong name, he is bound by a judgment if he appears and defends the cause.[8]

In New York the United States Ciruit Court decides that a railroad corporation, which has power by its charter to issue its own bonds, has power to guaranty the bonds of another railroad corporation, which it receives in payment of a debt due to it, and which it sells for value or transfers in payment of its own debts, the guarantee being given as the means of augmenting the credit of the bonds, or to enable it to obtain an adequate price for them.[9]

In Colorado, the Federal Court rules that the provision of the Colorado constitution declaring all railroads to be public highways does not prevent raising the question as to the character of a railroad in a proceeding by it to condemn land.[10]

In Massachusetts in an action for trespassing on railroad lands, the Supreme Judicial Court hold that evidence that for ten years the railroad company maintained a crossing over the lands for the accommodation of the defendant's private way, that during that time the defendant crossed there under claim of right, that subsequently, by contract with defendant for changing the line of the road, the company agreed to keep and maintain defendant's crossings over the new line as it was then required to do over the old line, is sufficient to sustain a finding that defiendant had, at the point where the said way crossed the new line and where the trespass is alleged to have occurred, a right of way which had been previously granted or reserved.[11]

In Pennsylvania it is held that under the statute of 1887 of that state "authorizing the condemnation of turnpikes," etc., a turnpike owned and operated by a railroad company may be condemned, but not the right of way of a railroad.[12]

In a suit against a railroad in Kentucky it appeared that the road on which the injury occurred was operated at the time by the defendant as successor of a company whose charter prescribed a limitation of six months within which such actions could be brought against it, but that the road was originally owned by another company whose charter did not contain such limitation. The Supreme Court rules that, in the absence of evidence as to the terms under which the defendant held possession, it must be presumed that the road was operated under authority of the charter of the company originally owning the same; that the fact that such company still has a corporate existence shows that it retains an interest in the road, and that the six months limitation does not apply.[13]

The Pennsylvania Act of 1881 provides that the Delaware Western (now consolidated with the Baltimore & Philadelphia) shall pay to the state, annually, in lieu of all taxes, such a sum as shall bear the same proportion to the sum of $40,000 as the length of the Delaware Western Railroad "bears to the length of the Philadelphia, Wilmington & Baltimore Railroad in this state. The Court of Errors of Delaware decides that the words "length of the Philadelphia, Wilmington & Baltimore Railroad in this state" mean the length of the main or trunk line, without reference to the lateral or branch lines.[14]

Injuries to Passengers, Employes and Strangers.

In Massachusetts the Supreme Judicial Court decides that a remark by a couductor to a passenger, who had taken a wrong train by his own fault, that the train would not stop at the point the passenger wished to go to, but that, by taking a rear car, he could get off at a station beyond and thence return to his destination, is not such a command or direction to pass from one car to another as justified the passenger in doing so at the risk of the railroad company. When a passenger goes from one car to another of a rapidly-moving train merely for his own cnovenience, he takes upon himself the risk of all accidents not arising from any negligence of the company.[15]

In the same state the same court holds that a railroad may exclude persons soliciting baggage from arriving passengers from its stations; that the statute providing that every railroad shall give to all persons equal facilities for the use of its depot, does not prescribe who shall have the use of the depot, but that all who have the right to use it shall be furnished with equal conveniences, and that where a railroad for the convenience of its passengers, allows a baggage expressman to keep a stand in its depot for receiving orders from passengers, the statute does not require it to furnish equal facilities and conveniences to all persons. But it should be noted that three of the judges dissented from these conclusions.[16]

In Virginia, in an action for the death of a brakeman, the evidence showed that the "push-pole" furnished by the railroad for the purpose of pushing cars upon a track running parallel with the engine, while it should have been sound and strong, was in reality cross-grained and defective; that the tender lacked the usual socket in which to place the end of the pole for operation; that the pole slipped, broke, and that the deceased involuntarily grasped the pole and was thrown in front of the advancing tender and killed. The Supreme Court hold the railroad liable.[17]

In Pennsylvania an engineer sued for injuries received in a collision. The accident occurred at H. station, where a double track road ended, and a single track extension began. About a mile south of H., on the double track road, there was a cross-over switch running from the north-bound to the south-bound track. Plaintiff was engineer of passenger train No. 10 going north. In clear weather it was customary, when there were freight trains detained on the north-bound track between the switch and the station, for signals to be given by whistles from the forward engine at H. to the rear engine near the switch, and if the south-bound track was clear No. 10 would move on to it, pass by the freight trains and proceed on its way on the single track extension. In foggy weather the forward engine near H. would act as a pilot engine, running down on the south-bound track to the switch, while the conductor of the forward freight train would remain at H. to signal any train coming south on the single track extension. When the pilot engine passed beyond the switch, No. 10 would move on to the south-bound track. The morning when the accident occurred was extremely foggy. Engine No. 287 going north was stopped at H., and behind it several coal trains. The operator at H. telegraphed this to the dispatcher, who replied that "No. 287 should arrange to get No. 10 arcund." No. 287 was accordingly run on to the south-bound track and moved down toward the cross-over switch. In the meantime No. 10 had arrived at the switch and slowed up. The conductor of the rear coal train, who was at the switch, signaled No. 10 to come on. Plaintiff accordingly ran No. 10 on to the south-bound track and increased his speed to 15 or 20 miles an hour in spite of the fog. Immediately afterward his train collided with No. 287, and he was severely injured. The rules of the company prohibited running on the south-bound track, and also required proper signals to be sent forward in case of detention. The Supreme Court hold that the plaintiff has no case against the railroad.[18]

In Arkansas, in an action for negligently causing the death of a freight conductor, it appeared that the accident occurred while deceased was running his train at an immoderate rate of speed over a bridge which was being repaired, when the bridge gave way. The Supreme Court rules that the company was not negligent in not giving the trainmen notice of the condition of the track, where the conductor knew that the repairs were being made, and the "slow boards" were out.[19]

In Missouri one of a gang of tracklayers was injured without negligence on his part by the falling of a temporary bridge which he was crossing on defendant's train. The bridge was designed for the passage of trains, the operation of a pile-driver, and the construction of a permanent bridge therefrom. The bridge had been in use for several days. All the details of the construction and inspection of the bridge were before the jury. The Supreme Court affirm a verdict against the railroad. The Court say that where a railroad furnishes for its employés a temporary bridge for the passage of construction trains, and the construction of a permanent bridge therefrom, the fact that the bridge was built under a competent foreman, and competent inspectors were afterward furnished, does not free it from liability to such employés for defects in the construction and repair of the bridge which it could, in the exercise of ordinary care, have known of.[20]

In a Georgia case the plaintiff's duty was to unload cars on a side track; 12 or 15 minutes before the accident he was warned not to move the cars; but in spite of such warning he applied his cross-bar to the cars, and set them in motion; and the cars moved down the side track, and collided with another train on the main track, whereby he was injured. The Supreme Court decided that as the accident resulted solely from his negligence he cannot recover.[21]

In North Carolina the Supreme Court rule that a person walking on a trestle-work on a railroad track, where the railroad company have by long consent allowed the public to pass and repass, is not a trespasser. In this case the defendant, in walking on the trestle after dark, where the public for 25 or 30 years had been accustomed to walk, got his foot caught. A construction train came slowly up and ran over him, with no head-light burning and without ringing the bell or blowing the whistle. The engineer had poor eyesight. Evidence for the railroad showed that deceased was at the time intoxicated; that the public had no right there, a notice of "No admittance" being posted, and that the engineer was competent and trustworthy. The Supreme Court affirms a verdict against the railroad.[22]

In Louisiana the Federal Circuit Court rules that where in an action for damages by one alleging that he had been jolted off a railroad train on which he was a passenger so as to strike a moving freight train and be thrown with his feet under the wheels of the freight train and thus received the injuries complained of, the evidence shows that claimant was injured in attempting without right to mount the freight train while in motion, he is not entitled to recover.[23]

In Illinois the Supreme Court hold that the fact that the statute may provide one precaution against danger at a railroad crossing does not relieve the company from adopting such others as public safety and common prudence may dictate, and the plaintiff may prove that no flagman had been stationed at a crossing, although no evidence was offered that the railroad was ever notified under the statute that a flagman was necessary.[24]

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1 State v. A. & N. R. Co., 38 N. W. Rep., 43.
2 Teachont v. D. M. B. G. R. Co., 38 N. W. Rep., 145.
3 Ga. Pac. R. Co. v. Strickland, 6 S. E Rep., 27.
4 Zemigue v. Tex. & Pac. R. Co., 34 Fed. Rep., 239.
5 Maxwell v. A., T. & S. F. R. Co., 34 Fed. Rep., 287.
6 Gilman v. W., St. L. & Pac. R. Co., 34 Fed. Rep., 257.
7 St. L., K. & N. W. R. Co. v. Wab., St. L. & P. R. Co., 34 Fed. Rep. 254.
8 Penn. Co. v. Sloan, 14 West. Rep., 379.
9 Rogers L. & M. Works v. South. R. R. Assn., 34 Fed. Rep., 278.
10 Denver R., L. & C. Co. v. U. P. R. Co., 34 Fed. Rep., 386.
11 Fitchburg R. Co. v. Frost, 6 New Eng. Rep., 374.
12 Phila., N. & N. Y. R Co.'s Appeal, 12 Cent. Rep., 363.
13 Kentucky Cent. R. Co. vs. Kenney, 8 S. W. Rep., 201.
14 Herbert v. B. & P. R. Co., 12 Cent. Rep., 349.
15 Stewart v. B. & P. R. Co., 6 New Eng. Rep., 273.
16 Old Colony R. Co. v. Tripp, 6 N. Eng. Rep., 366.
17 N. & W. R. Co. v. Jackson, 6 S. E. Rep., 220.
18 West v. Keim, Receiver, 12 Cent. Rep., 381.
19 St. L., I. M. & S. R. Co. v. Morgart, 8 S. W. Rep., 179.
20 Bowen v. C., B. & K. C. R. Co., 8 S. W. Rep., 230.
21 Ga. Pac. R Co. v. Mapp, 6 S. E. Rep., 24.
22 Troy v. C. F. & Y. V. R. Co., 6 S. E. Rep., 77.
23 Mo. Pac. R. Co. v. Carter, 34 Fed. Rep., 92.
24 C., B. & Q. R Co. v. Perkins, 14 West Rep., 400.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Albany, two per cent., payable Sept. 29.
Fort Wayne & Jackson, semi-annual, 2¾ per cent. upon the preferred stock.

Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chicago & Atlantic, annual meeting, Huntington, Ind., Sept. 6.
East Tennessee, Virginia & Georgia, special meeting, Knoxville, Tenn., Oct. 18.
Nashville, Chattanooga & St. Louis, annual meeting Nashville, Tenn., Sept. 12.
Northwest & Florida, special meeting, Montgomery, Ala., Aug. 30.
Northern Pacific, annual meeting, Mills Building, New York City, Sept. 20.
Vincennes, Oakland City & Owensboro, annual meeting, Boonville, Ind., Sept. 3.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Roadmasters' Association of America* will hold its sixth annual convention at the Metropolitan Hotel, in Washington, D. C., commencing at 9 a. m., Tuesday, Sept. 11, and continuing in session three days.

The *National Association of General Passenger and Ticket Agents* will hold its fall meeting at the United States Hotel, in Saratoga, N. Y., Sept. 18.

The American Society of Mechanical Engineers will hold its eighteenth convention and ninth annual meeting in Scranton, Pa., beginning Monday evening, Oct. 15.

The *Association of North American Railroad Superintendents* will hold its next meeting at the Southern Hotel, St. Louis, beginning Sept. 19.

The *Master Car and Locomotive Painters' Association* will hold its nineteenth annual convention at the Hollenden Hotel, in Cleveland, O., commencing Sept. 12, at 10 o'clock a. m.

The *American Institute of Mining Engineers* will hold its fifty-second meeting at Buffalo, N. Y., beginning on Tuesday evening, Oct. 2, 1888.

The *American Association of Railway Chemists* will hold its next meeting in Baltimore, Md., in October

The *New England Railroad Club* meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.

The *New York Railroad Club* meets at its rooms, 113 Liberty street, New York City, on the third Thursday of each month.

The *Western Railway Club* will hold its next meeting on the third Wednesday in September, at the Grand Pacific Hotel in Chicago.

The *Central Railway Club* meets at the Tifft House, Buffalo, the fourth Wednesday of January, March, May, August and October.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its next regular meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of September.

The *Western Society of Engineers* holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.

The *Engineers' Club of Philadelphia* will hold its next meeting in Philadelphia, Oct. 6.

The Engineers' Society of Western Pennsylvania will hold its next meeting at Pittsburgh, Sept. 18.

The Engineers' Club of Kansas City will hold its next regular meeting Sept. 3.

New England Water-works Association.

The regular quarterly meeting of this association will be held at Cambridge, Mass., on Wednesday, Sept. 12, and will be observed as a field day gathering.

A short business meeting will be held, and carriages will be taken for a drive through the most interesting parts of the city of Cambridge. A short stop will be made at Harvard University, after which the party will be taken around the shores of Fresh Pond storage basin and arriving at the Pumping Station at 11 o'clock a. m.

A lunch will be served at this place and ample opportunity offered for the inspection of the pumping machinery.

The party will leave the pumping station at 12 o'clock m. by a special train for an inspection of the recently completed Stony Brook storage reservoir. Returning they will arrive at North Cambridge station at 2 o'clock p. m., at which place they will be transferred to horse cars and conveyed through North avenue and Main street to Union Hall, where a complimentary dinner will be tendered the Association by the City Government at 3 o'clock p. m.

PERSONAL.

—J. H. Klein, Trainmaster of the Eastern Division of the Lake Erie & Western Railroad, has resigned, to take effect Sept. 1.

—Mr. James G. Dagron has resigned his position as General Manager of the Bridge and Construction Department of the Pencoyd Iron Works.

—The wife of Mr. Sigismund Low, and mother of Mr. Emile Low, both well known civil engineers, died Aug. 13, at her home at Glenwood, near Pittsburgh.

—Mr. C. S. Mellen, General Purchasing Agent of the Union Pacific, has been appointed Assistant to Acting General Manager Kimball until Mr. Kimball is restored to health.

—Mr. F. M. Marsh has been appointed Superintendent of Bridges and Buildings of the Fremont, Elkhorn & Missouri Valley Railroad Co. (Chicago & Northwestern), with headquarters at Omaha.

—Mr. G. W. Ettinger has resigned his position as Master Mechanic of the Newport News Division of the Chesapeake & Ohio to accept an appointment on another road. He has been succeeded by Mr. W. J. Haller.

—Mr. Frank Milligan, General Passenger and Ticket Agent of the St. Joseph & Grand Island, has presented his resignation, to take effect Oct. 1. Mr. Milligan has held this position for three years, and was previously General Passenger and Ticket Agent of the Detroit, Mackinac & Marquette, and the Marquette & Western.

—Mr. Robert W. Jones, Master of Transportation on the Pittsburgh & Lake Erie, has tendered his resignation, to take effect Sept. 1, and will engage in private business. Mr. Jones is 46 years old, 28 of which have been spent in railroad service. He has held the position of Master of Transportation of the Pittsburgh & Lake Erie for nearly 10 years, and since 1883 he has held the same position on the Pittsburgh, McKeesport & Youghiogheny, a leased line of the former road. Before his connection with the Pittsburgh & Lake Erie Mr. Jones was Superintendent of Telegraph and Supervisor of the Trans-Ohio Division of the Baltimore & Ohio.

ELECTIONS AND APPOINTMENTS.

Astoria & South Coast.—The following are the incorporators of this new Oregon company: M. J. Kinney, W. W. Parker, E. A. Noyes, M. C. Crosby, H. B. Parker, James Taylor and J. W. Conn.

Austin & Northwestern.—Mr. F. H. Halloway has been appointed Commercial Agent, with headquarters at Burnet, Tex., and will have immediate charge of the live stock, cotton and wool traffic of the company.

Central of Georgia.—D. D. Curran has been appointed Superintendent of the South Carolina Division, with office at Augusta, Ga., to succeed W. N. Starr, appointed Superintendent of the Southwestern Division.

Chesapeake & Ohio.—F. A. Given has been appointed Master Mechanic of the Huntington Division, with office at Huntington, W. Va., and W. J. Haller has been appointed Master Mechanic of the Newport News Division, vice G. W. Ettenger, resigned to accept a position elsewhere.

Soloman Haas has been appointed Traffic Manager, appointment to take effect Nov. 1.

Chicago West Division Elevated.—The first board of directors are: Andrew Onderdonk, of New York; James Ross, of Sherbrooks, Que.; William D. Howard, John J. P. O'Dell, James Deering, George T. Willis and William G. McCormick, of Chicago.

Cleveland, Chagrin Falls & Northern.—The following have been elected directors of this new company, which is controlled by the Cleveland & Canton: J. H. Wardwell, of Cleveland; Charles H. Blood, of Boston; H. A. Kennedy, of Canton; Edward Briggs and E. F. Blood, of Cleveland. At a subsequent meeting the Board elected J. H. Wardwell President; Charles H. Blood, Secretary and Treasurer, and H. A. Kennedy, Chief Engineer.

Detroit, Lansing & Northern.—George H. Graves has been appointed Freight Agent for the city of Grand Rapids, Mich.

Flint & Pere Marquette.—A circular hasb een issued announcing that the resignation of Mr. H. C. Potter as General Manager has been accepted. The Assistant General Manager, Mr. D. Edwards, will continue in charge of the passenger and freight business, and the Superintendent, Mr S. Keeler, will continue in charge of motive power and transportation, both, however, to be under the general direction of the President, to whom communications referring to general business affecting the policy of the company should be addressed.

Harold, Garden City & Southwestern.—The directors of this New Kansas company are as follows: W. N. Dilley, J. L. Findlay, E. H. Borton, Perry McWetlev, J. M. Rankin, of Harold; R. J. Kenyon, of Kidderville; H. I. Benton, of Jetmore; C. E. Gallagher, of Dodge City, and Z. T. Nelson, of Garden City.

Huntsville Belt Line & Monte Sano.—W. K. P. Wilson, of Huntsville, Ala., is President of this company, and Arthur Owen Wilson, Birmingham, Ala., is Secretary-Treasurer and Chief Engineer.

Kansas City, El Paso & Mexican.—At a meeting of the stockholders held at Las Crueses, N. M., recently, the following directors were elected: H. L. Newman, of St. Louis; B. H. Davis, James Magoffin, C. R Morehead and Z. B. Clardy, of El Paso; T. W. Herman, J. C. Lea, C. B. Eddy and James R. Waddie, of New Mexico. The following officers were elected: H. L. Newman, President; Z. B Clardy, Vice-President; Morris B. Locke, Secretary; S. W. Russell, Treasurer; C. S. Masten, Chief Engineer.

Louisville & Nashville.—J. G. Metcalfe, Superintendent of the Henderson & St. Louis division, has been made Superintendent of the South & North division, with office at Birmingham, Ala., to succeed D. Allen, who is appointed Superintendent of the St. Louis & Henderson division.

Mason County Central.—The following are the directors of this new Washington company: W. H. Kneeland, Martin Lewis and N. H. Owings. The principal place of business is to be Shelton, W. T.

Mount Olive Coal.—The following are the incorporators of this Illinois company: A. C. Grubb, H. L. Jeffries, A. T. Alvy, H. M. Wing and J. C. McDaniels, all of Springfield.

Rome & Carthage.—At a meeting recently held in Copenhagen, N. Y., the following officers were elected: President, James C. Smith, of Rome; Vice-President, Chester Ray, of Martinsburg; Secretary and Treasurer, A. W. Orton, of Rome; Executive Committee, Charles A. Chickering, of Copenhagen; M. C. West, Owen E. Owens, and G. V. Selden, of Rome.

St. Louis, Baxter Springs & Oklahoma.—The following are the incorporators of this Kansas Company: J. E. Murdock, Galena, Kan.; H. Horne and C. H. Weagley, Baxter Springs; Edward Burgess, James Knivly, C. M. Alexander, Patrick Harrison and Alexander Douglas, St. Louis.

Toledo, Saginaw & Muskegon.—The following officers and directors were elected at a recent meeting in Detroit: President, Joseph Hickson; Vice-President and General Manager, W. J. Spicer; Secretary and Treasurer, J. H. Muir; Directors, Joseph Hickson, W. J. Spicer, Henry Howard, C. J. Church, A. B. Maynard, L. L. Stanley, George Masson, F. E. Rankin, E. W. Meddaugh, L. G. Middleton and L. G. Mason.

Union Pacific.—The following circular has been issued by President Adams: Acting General Manager Kimball being temporarily incapacitated by illness from performing the duties of his office, he has requested that those duties be performed, until he shall recover his health, by General Purchasing Agent C. S. Mellen. Mr. C. S. Mellen is, therefore, hereby designated to perform the duties of assistant to Mr. Kimball until otherwise ordered. All papers which would have been addressed to the Acting General Manager will be forwarded to Mr. Mellen, who will take action accordingly with the full power and authority of the Acting General Manager.

Vincennes, Oakland City & Owensboro.—The following are the names and addresses of the officers: J. C. Rudd, President, Owensboro, Ky.; Edward Watson, Vice-President, Vincennes, Ind.; C. W. Bransford, Secretary, Owensboro, Ky.; W. A. Oliphant, Treasurer, Union, Pike County, Ind.; J. B. Cockrum, General Solicitor, Boonville, Ind.

OLD AND NEW ROADS.

New Companies Organized.—Astoria & South Coast.—Beatrice, Nebraska City & Northwestern.—Chicago West Division Elevated.—Decatur, Chesapeake & New Orleans.—Harold, Garden City & Southwestern.—Mason County Central.—Mount Olive Coal.—St. Louis, Baxter Spring & Oklahoma.—Toledo & Ohio Central Extension.

Alabama Great Southern.—The work of relaying the track from Chattanooga to Meridian with new 60-lb. steel rails has been finished with the exception of between York and Kewanee, which will soon be finished. The entire track will then have 60-lb. rails for a distance of 295 miles.

Astoria & South Coast.—Incorporated in Oregon to build a road from Astoria to the head of tide water in Tillamook Bay and from a point on the main line to Fort Stevens Much of the right of way has been secured. The capital stock is $75,000.

Atlantic, Tennessee & Western.—The franchises of this road were sold Aug. 22 to Dr. John M. Bailey, of Bristol, Tenn. The company is a Tennessee corporation which proposed to build a standard gauge road from Carter's, a station on the East Tennessee, Virginia & Georgia, across East Tennessee, traversing the magnetic iron ore fields of East Tennessee to Western North Carolina. The company has large county subscriptions and much local aid; some considerable work has been done. It is the purpose of Dr. Bailey to consolidate this road with the Bristol & South Atlantic, which the Bailey-Jones Construction Co. has a contract to build. The latter road will open up the three great iron counties of Tennessee, viz.: Carter, Johnson and Unicoi. It will connect at Elizabethton with the Cranberry iron mines, through the East Tennessee & Western North Carolina road, as well as with the coking coals of Scott and Wise counties in southwestern Virginia by means of the South Atlantic & Ohio. The ultimate object of the company is to extend its Unicoi branch to Asheville, N. C., and its eastern branch to a connection with the railroad systems of of North Carolina in the vicinity of Morganton.

Ballona & Santa Monica.—The survey for this road has been completed between Ballona and Santa Monica, Cal., and it is stated that grading will begin as soon as the right of way has been secured. James Campbell, of Los Angeles, is a director of the company.

Beatrice, Nebraska City & Northwestern.—Incorporated in Nebraska to build a road from Beatrice to Nebraska City and Weeping Water, and thence to Wahoo. The incorporators are residents of Nebraska City. It is stated that the road is to be built in the Burlington & Missouri River interest.

Birmingham Mineral.—Tracklaying has now been completed on the branch from Gate City to Trussville, Ala. On the Huntsville branch from Village Springs to Chepultepec, Ala., grading has been completed for ten miles, and tracklaying will soon commence.

Bowling Green & Ohio River.—The projectors of this Kentucky route, from Bowling Green to Henderson, have abandoned the scheme of building the road between these points, owing to the lack of interest in the project, but an effort will be made to secure an outlet from Bowling Green to some other point.

Central of New Jersey.—The survey is completed for the new branch from a point near Roselle to Elizabethport, a distance of about six miles, for the Baltimore & Ohio's outlet to the seaboard over the Arthur Kill bridge, is completed.

Chattanooga, Hiawasse & Augusta.—The election held in Cherokee County, N. C., last week, on the question of issuing $50,000 in bonds to aid in the construction of this road, which it is proposed to build from Murphy via Cleveland to Chattanooga, Tenn., 94 miles, resulted in favor of the subscription.

Chattanooga, Rome & Columbus.—An injunction has been obtained, restraining the city of Chattanooga, Tenn., from issuing the $100,000 in bonds which were voted this road about a year ago.

Chicago & Indiana Coal.—The extension from Goodland, Ind., to a connection with the Chicago & Eastern Illinois at Momence, Ill., has now been completed for a distance of 26 miles, leaving 10 miles to complete the road to Momence.

Chicago West Division Elevated.—Charter filed in Illinois to construct an elevated road, to start in the business district of the South Side of Chicago, cross the river with a tunnel line between Harrison and Lake streets, and run branches to the more thickly populated portions of the West Division.

Chicago & West Michigan.—It is reported that the road contemplates building a branch from some point on the line between La Porte, Ind., and the Michigan state line to connect with the docks at Michigan City, the road to be built chiefly in the interest of the Chicago & Indiana coal road, which has been running rights over the Chicago & Western in Indiana.

Dallas, Archer & Pacific.—The survey has been completed through Grapevine, Tex., and it is stated that grading has been commenced at Letott's, near Dallas, Tex., on the Missouri, Kansas & Texas.

Decatur, Chesapeake & New Orleans.—The company, which is now constructing a road from Shelbyville, Tenn., towards Decatur, Ala., has filed articles of incorporation in Alabama to construct a road from Lincoln County, Tenn., across the Tennessee River to Decatur, thence southwesterly to Mississippi, and thence to New Orleans. The incorporators are residents of Decatur, and the capital stock is placed at $200,000.

Dodge City, Montezuma & Trinidad.—The road has now been completed from Dodge City to Montezuma, Kan., a distance of 30 miles, and the first train entered Montezuma Aug. 24. The road will soon be opened for regular traffic.

Farmville & Powhatan.—At an election held in Farmville, Va., this week the road was voted $50,000 to aid in grading an extension from Farmville and Cumberland Court House, Va.

Gulf, Colorado & Santa Fe—The extension from Ballinger to San Angelo, Tex., is expected to be open for regular traffic Sept. 2.

Harold, Garden City & Southwestern.—Chartered in Kansas to construct a road from Harold, Ness County, to Garden City, and from thence to the south line of the state. The capital stock is $250,000.

Huntsville Belt Line & Monte Sano.—Grading on this road has now been completed for over seven miles, and tracklaying has been finished on the first five miles. The road is being constructed from the Memphis & Charleston depot, in Huntsville, to the Hotel Monte Sano, in Monte Sano, Madison County, Ala. The distance is 8½ miles, and the maximum grade is four per cent. The road is being constructed by the Wilson & Co. Construction Co., and the grading contract has been let to Danforth & Armstrong, of New York.

Interoceanic.—The *Mexican Financier* learns that the chief engineer of the road, Mr. Alexandre, has arrived and will remain until the road is completed between Vera Cruz and the City of Mexico. The first work will be the construction of the 45 miles between Pueblo and Mazapa, giving a direct line between Pueblo and the City of Mexico. It is proposed to put on dining cars between Pueblo and Mexico. It is understood in London that the line will surely be pushed to Acapulco, on the completion of the division between Vera Cruz and Mexico.

Irvington, Hardinsburg & Southwestern—Surveyors began locating the line of this proposed Kentucky road this week, and it is expected to have the line completed by October

Kansas City, El Paso & Mexican.—At a recent meeting of the stockholders it was voted to issue bonds for constructing the road. The contract with Morris R. Locke & Co. for building the road between El Paso, Tex., and White Oaks, N. M., 160 miles, was ratified. Sub contracts for the first ten miles from El Paso have been let.

Kansas City, Memphis & Birmingham.—The company will build a two-mile branch line from Jasper to coal mines in Walker County, Ala.

Kansas City & Sabine Pass.—It is stated that it is now very probable that the route south of Ellis, Mo., will be very materially changed and that Lamar and Peirce City will be left several miles to the east. It is announced that the reason of this change is because the cities are 15 miles out of a direct line, and to reach them requires heavy construction; again, the places have refused to issue bonds to aid the road in building its line, another, and perhaps the most conclusive reason, is that another road is making active preparations to build a line through both the cities.

Louisville, St. Louis & Texas.—The condemnation suits of this company for right of way at Owensboro, Ky., have all been settled in the company's favor, and the work of building the breach in the line will begin at once.

Maine Central.—At a meeting of the stockholders last week it was voted to ratify the lease of the Portland & Ogdensburg. The whole number of votes cast was 27,993 out of a total of 35,935, more than the necessary two-thirds. The stockholders of the Portland & Ogdensburg have also ratified the lease.

Manchester & Portland.—The New York *Times* states that the survey will be commenced in October for this road, which is to be built from Rockville, Conn., to a connection with the New York, New Haven & Hartford at Portland. The new line will run under the New York & New England at Vernon, link together the manufacturing centres at South Manchester, Burnside and Glastonbury. The New York, New Haven & Hartford road will receive the business diverted from the New York & New England by the new line—when it is built.

Mason County Central.—The company has been incorporated in Washington Territory to build a road from Shelton to a point on the Chehalis River, and to operate steamship lines. Engineers are surveying the route of the road, and the contract for the construction of the first section from Shelton will probably be let soon. The road will be about 3 miles long.

Memphis, Little Rock & Indian Territory.—The survey for this road has just been completed from Littl Rock to Hot Springs, Ark. F. F. Smith is one of the incorporators.

Mexican National.—The Tampico branch of the Mexican Central has lately been completed to San Luis Potosi from Aguas Calientes, and now the citizens are getting ready to celebrate the opening of this road.

Milledgeville & Asylum.—Nearly all the grading on this road is now completed and tracklaying has been commenced at the depots in Milledgeville, Ga.

Mount Olive Coal.—The company has filed articles of incorporation in Illinois to construct a road from Litchfield to Mount Olive. The capital stock is $100,000 and the principal office is at Springfield.

Nashville, Chattanooga & St. Louis.—It is expected to have the Duck River Valley road or Columbia branch, changed to standard gauge between Petersburg and Lewisburg, Tenn., 15 miles, by Sept. 15. Nine miles have already been changed. Hunter McDonald, Assistant Engineer, has charge of the work.

Nebraska Southern.—A special election was held in the city of Kearney, Neb., and it was voted to issue $55,000 bonds to the road.

New Roads.—Citizens of Victoria, B. C., have organized a company to build a road from Victoria to Shoal Harbor, 18 miles, thence by a ferry to the mouth of the Frazer River, 25 miles, and thence to New Westminster, about 12 miles, connecting at the latter place with proposed extensions of the American roads.

Savannah, Tenn., has voted $50,000 to the Savannah & Corinth, and $125,000 to the Savannah & Florence.

New York, Ontario & Western.—Contracts for the Wharton Valley road, which is to be constructed from New Berlin to Edmeston, N. Y., a distance of seven miles, have been let to W. R. Haven, of Middletown, N. Y.

Owensboro, Falls of Rough & Green River.—The contract has been let to J. W. M. Field, and it is stated that work will soon begin at both Owensboro and Falls of Rough. The road is to be finished within a year ready for operation. The rolling stock is also to be furnished. J. W. M. Field will have charge of the work, with headquarters at Owensboro, Ky.

Owensboro, West Louisville & Sebree City.—Prominent citizens of Western Kentucky have formed a company to build this road from Owensboro to Sebree City, Ky., a distance of 45 miles. Officers of the company will be elected at Beech Grove, Ky., Sept 15.

Pennsylvania.—The company will next week commence work on its additional shops at Altoona, Pa., which are to cost about $500,000.

Port Townsend Southern.—The survey for this road has now been completed from Port Townsend south to the Quilcene River, a point 30 miles distant. The survey will be continued south as rapidly as possible.

Pueblo, Gunnison & Pacific.—The stock books of the company have been opened at Pueblo, Colo., and it is thought that the survey will be commenced in September. The road is projected to extend from Pueblo to Gunnison, Colo. H. R. Holbrook, Pueblo, is Chief Engineer.

Raritan River.—The company has connected its track with that of the New York & Long Branch at South Amboy, N. J., and with the Pennsylvania at a point about three miles west, and tracklaying is in progress from those points and is being completed as rapidly as possible to Bound Brook, 15 miles from South Amboy.

Rome & Decatur.—The road is now in operation between Rome, Ga., and Atalla, Ala., a distance of about 62 miles. The survey for the extension to Decatur, Ala., has been nearly completed, and it is thought that grading will soon be commenced. The road is laid with 60-lb. steel rails. S. G. Ruff is engineer in charge of construction and Col. D. Callahan, of Rome, Ga., is the contractor.

St. Louis, Arkansas & Missouri.—The company is filing for record in Missouri copies of two mortgages, one for $1,170,000 and the other for $9,500,000. The mortgages cover the company's roads in Missouri, Arkansas and Texas, including branches, rolling stock, etc., and the extension from Malden, north to a point on the Mississippi River, opposite Grand Tower. The Mercantile Trust Co., of New York, is the mortgagee.

St. Louis, Baxter Springs & Oklahoma.—Incorporated in Kansas to build a road from St. Louis to a point on the western border of Tucker County, Ill., thence to Galena, Baxter Springs and Coffeyville in Kansas, and then southwesterly through the Indian Territory and to Oklahoma County, Tex., with a branch from Baxter Springs to Kansas City, Mo., and a branch to Fort Smith, Ark. Estimated length of road, 300 miles, and the capital stock is placed at $10,000,000. A survey is now being made between Galena and Coffeyville via Baxter Springs, Kan.

St. Louis & Northwestern.—The survey for the line was completed to Shelbyville, Mo., last week. The road is to run from Omaha, Neb., through the southwestern portion of Iowa to Unionville, Kirksville and Shelbyville, thence to Hannibal and from there to St. Louis. The line can be comparatively cheaply constructed, and will pass through a productive territory. S. M. Pickler, of Kirksville, is President.

San Antonio & Aransas Pass.—The company has agreed to extend the road to Waco, Tex., by June 1, 1889, if the right of way and $25,000 is granted.

San Gabriel Valley Rapid Transit.—The road ha now been completed from Monravia westward to Los Angeles, Cal., a distance of 16 miles, and was opened for regular traffic Aug. 21.

Savannah, Florida & Western.—That part of the Thomasville, Tallahassee & Monticello from Thomasville to Metcalf was placed in operation Aug. 22. The road is being constructed from Thomasville, Ga. to Monticello, Fla., 24 miles.

Sonora, Sinaloa & Chihuahua.—This road, which is projected to run from Deming, in New Mexico, southwest to Guayaras, effected an organization at Deming a few days ago, by electing George H. Sisson, of New York, President; James A. Williamson and John A. Lee, of Albuquerque, Vice-Presidents; Wm. S. Strickler, of Albuquerque, Secretary, and Charles H. Dane, of Deming, Treasurer. The road expects to utilize the surveys of the Deming, Sierra Madre & Pacific Railroad.

South Brunswick Terminal.—It is stated the company has placed the bonds for constructing its road in New York. J. F. Penniman, Brunswick, Ga., is President.

Tennessee & Coosa.—The suspension of work on the extension of this road, referred to last week, was caused by some difficulty in negotiating the bonds. Eleven miles of the road are in operation and work was progressing on the balance, 65 miles, all of which has been carefully located and the right of way secured. Plans were in preparation for a bridge across the Tennessee River at Guntersville. Mr. William H. Case, Chief Engineer and General Manager, resigned his position on the failure of the company to properly equip the road and finish the work. It is expected that arrangements will soon be made to continue and complete the work.

Toledo & Ohio Central Extension.—The company has filed articles of incorporation in Ohio. The capital stock is placed at $1,500,000.

Toledo, Saginaw & Durand.—Tracklaying on this road has now been completed from East Saginaw to Durand Mich., a distance of 52 miles. It connects at Durand with the Grand Trunk system and the Toledo, Ann Arbor & North Michigan, both of which are negotiating for the purchase or lease of the new line.

Vancouver, Klickitat & Yakima.—Work on this road has been suspended until the negotiations for placing the bonds have been concluded. The road has been graded ready for tracklaying for six miles out from Vancouver, Wash. T.

Virginia & Carolina.—The partly graded road-bed, right of way, franchises, etc., of the company were sold at Richmond, Va., last week, to Moncure D. Robinson and others, guaranteed stockholders, for $165,000. The sale is subject to a debt of $101,640 due the city of Petersburg, Va., which is a lien on the property of the purchaser. The road was projected to extend from Petersburg to Ridgeway, N. C., 60 miles.

TRAFFIC AND EARNINGS.

Traffic Notes.

The transcontinental tariffs fixed by the Transcontinental Association make Chicago-San Francisco rates on many articles materially higher than New York-San Francisco. Most of the Missouri River roads have refused to adopt the new rates.

A car is run between New York and Omaha purposely to carry less than car load lots of merchandise and in quick time. It is run by the Merchants' Dispatch, and over the C., B. & Q. The regular schedule is 5 days and 10 hours, though often this time is beaten considerably. The car leaves New York every night, and is run through to Omaha without transfer or delay.

The Central Pacific will discontinue after Sept. 1 one of its overland trains from San Francisco, leaving but one daily.

The Wisconsin Central, the St. Paul & Kansas City and the Burlington & Northwestern have agreed to restore freight rates to St. Paul Sept. 2. It was also agreed to restore passenger rates to St. Paul on the same date.

A new fast freight service is to be begun by the Kansas City, Memphis & Birmingham, between Kansas City and New York, by rail to Savannah and thence by steamer to New York.

The new steamship "City of Birmingham" sailed last week from Savannah, Ga., with a cargo of 2,100 tons of pig-iron for Philadelphia. The "City of Birmingham" was built by the Central of Georgia, and this shipment came direct from Alabama furnaces.

The general passenger agents of the Chicago, St. Louis & Missouri roads sent notice Aug. 27, to the Eastern Trunk lines, cancelling any authority which may heretofore have been given for the use of any net rate on foreign immigrant business, or the use of any charge for terminal expenses in excess of 10 per cent., not exceeding $1 per ticket, and requiring the restoration of full agreed tariff rates and proportions on emigrant business, to take effect not later than Sept. 2. Similar action had already been taken by the Northwestern lines. This, it is expected, will confine the immigrant rate troubles to trunk line territory.

The trunk lines have agreed to abolish all differential rates on west-bound freight to all points east of Toledo and Detroit after Sept. 10.

The Pittsburgh, Fort Wayne & Chicago has met the rates on grain to interior points in Central Traffic Association territory. The reduction amounts to from 1 cent per 100 lbs. to 4 cents, according to distance, and includes all competing points in Indiana and Ohio. The Cleveland rates are reduced 2 cents. The rates are made flat both on milling in transit and regular business. A meeting of the Freight Commissioners of the Association will be held in Chicago to-day for the purpose of restoring these rates.

Injunction Against the Iowa Commissioners.

At Iowa City, Aug. 28, Judge Fairall, sitting as Chancellor, filed his opinion in the case of the Iowa roads against the Iowa Railway Commissioners, and in the test case of the Chicago, Rock Island & Pacific Railway against the Commissioners, to restrain them from putting into effect the schedule of rates prepared by the Commissioners in pursuance of the recent law of the Legislature. The injunction is sustained.

As to the jurisdiction of the Court of the subject matter of the action, this is sustained on the ground that while the Commissioners are authorized to exercise a discretion in fixing rates yet when they fix rates too low to enable the plaintiff to pay fixed charges and operating expenses, then their acts contravene the spirit of the statute, which requires rates to be reasonable and just, and is in violation of the constitutional provisions which entitle the common carriers to a reward for their services. The Commissioners appealed to the Supreme Court.

Chicago-New York Provision Rates

The Chicago & Atlantic and the Erie have withdrawn the notice given last week that the rate on provisions to New York would be advanced to 30 cents on Sept. 1. The Pennsylvania and Vanderbilt lines declined to meet the proposed action by the Erie, and declared that for the present they would continue to quote the 18-cent rate on provisions. It is supposed that they will keep up a fight as long as the Erie maintains its differential on dressed beef.

Kansas City Grain Shipments.

A dispatch from Kansas City says that the fight among the railroads to carry Kansas flour to Antwerp and Glasgow has about reached its limit, but it is still bitter. It is now 6 cents cheeper to ship flour across the ocean than it is to New York. But little grain and flour are being shipped from this city and Kansas points to the seaboard. Nearly all of the grain moving eastward has been put in the elevators at Alton and St. Louis, although there has been quite a movement from Kansas City to Baltimore. The foreign shipments, however, promise to be much larger than usual.

Discrimination Between Railroads.

A suit has been filed by the Louisville Southern against the Louisville & Nashville to restrain the latter road from refusing to deliver freight to the Louisville cotton mills, and also from refusing to receive from and deliver to the Louisville Southern all other freight. The suit was brought in the Law and Equity Court. It is said to be the first suit ever brought in a state court under the Inter-state Commerce law. The facts in the case are as follows: A lot of lumber was shipped from Chattanooga for delivery to the cotton mills, by the tracks of the transfer road owned by the Louisville & Nashville. The lumber was shipped via the Louisville Southern, but the Louisville & Nashville refused to deliver it at the cotton mills switch. The Louisville & Nashville has refused to deliver other freight from the Southern to points in Louisville, though taking freight for delivery on its switches from all other roads. The Louisville & Nashville also agreed with the cotton mills people to deliver cotton, wool and lumber on its switches from all roads except the Louisville Southern. The latter road alleges this to be a violation of the Inter-state Commerce law. A temporary injunction was issued by the Court.

Southwestern Live Stock Rates.

The Missouri Pacific and the St. Louis & San Francisco have met the reduction in live stock rates from Kansas and Indian Territory points to St. Louis and Chicago. The reduction is very great, and, if continued, will have a serious effect on earnings. The Rock Island and the Santa Fe began the cut.

Cotton.

The cotton movement for the week ending Aug. 24 is reported as follows, in bales:

	1888.	1887.	Inc. or Dec.	P. c.
Interior markets:				
Receipts	8,020	15,949	D. 7,929	49.8
Shipments	8,573	15,679	D. 7,406	47.1
Stock	15,991	23,256	D. 7,265	31.3
Seaports:				
Receipts	18,517	19,270	D. 703	3.6
Exports	9,657	22,315	D. 12,658	57.3
Stock	179,306	93,312	I. 85,994	86.6

The coal and coke tonnage of the Pennsylvania originating on lines east of Pittsburgh and Erie for the week ending Aug. 25, and the year to that date, was as follows:

	Coal.	Coke.	Total.
Total for week ending Aug. 25.	205,857	50,905	256 762
Total for year 1888 to date	7,541.339	2,488.206	10,029,545
Total for year 1887 to date	6,712,649	2,168,682	8,881,331

The anthracite coal tonnage of the Belvidere division of the United Railroads of New Jersey division for the same periods was as follows:

	1888.	1887.	I. or D.
Total for week ending Aug. 25	37,402	26,941	I 10,460
Total for year to Aug. 25	1,025,551	1,097,619	D. 71,964

The Cumberland coal trade for the week ending Aug. 25 amounted to 69,517, tons and for the year to that date 2,264,562 tons.

Coal.

The coal tonnages for the week ending Aug. 25 are reported as follows:

	1888.	1887.	Increase.	P. c.
Anthracite	832,058	728,183	103,875	14 2
Bituminous	316,503	265,767	50,736	18.7

The coal and coke tonnage of the Pennsylvania originating on lines east of Pittsburgh and Erie for the week ending Aug. 18, and the year to that date, was as follows:

	Coal.	Coke.	Total.
Total for week ending Aug. 18	219,680	78,087	297.767
Total for year 1888 to date	7,335.482	2,437,301	9,772,783
Total for year 1887 to date	6,528,066	2,082,519	8,610,585

The anthracite coal tonnage of the Belvidere division of the United Railroads of New Jersey division for the same periods was as follows:

	1888.	1887.	Inc. or Dec.
Total for week ending Aug. 18	38,793	29,007	I. 9,785
Total for year to Aug. 18	988,251	1,070,677	D. 82,425

Railroad Earnings.

	1888.	1887.	Inc. or Dec.	P. c.
Month of July:				
Cleve. & Canton.	$30,523	$29,035	I $1 488	5.1
Net	9,064	8,695	I. 369	4.2
Leh. & Wilkesb.	824,533	715,250	I. 109,283	15.2
Net	178,254	118,653	I. 59,601	40.9
Pennsylvania Co.:				
Northw'n Sys.	1,374,447	1,518,121	D. 143,674	9 4
Net	410,742	503,801	D. 93,059	1.8
Southw'n Sys.	1,074,848	1,184,154	D. 109,306	9.2
Net	241,962	325,148	D. 83,186	22.1
Staten Isl. R. T.	145,362	124,308	I. 20,954	16.0
Net	69,002	53,342	I. 15,660	29.3
N. Y., L. E. & W.	2,378,769	2,330,285	I. 48,484	2.0
Net	630,624	631,854	I. 1,230	0.1
Month of June:				
C., In., St. L. & C	219,805	217,726	I. 2,079	0.9
Net	86,380	70,764	I. 15,616	22.0
Ft. W. & Den. C.	86,202	44,221	I. 41,981	94.9
Net	30,989	11,765	I. 19,224	162.9
Oreg. Short Line	227,020	180,554	I. 46,466	25.7
Net	103,813	71,729	I. 32,084	45.3
Six months—Jan. 1 to June 30:				
C., I., St. L. & C.	1,261,964	1,285,727	D. 23,763	1.8
Net	476,228	488,212	D. 11,984	2.4
F. W. & D. C.	440,386	290,230	I. 150,156	51.7
Net	157,059	105,978	I. 51,081	48.1
Oreg. Short Line	1,175,775	921,814	I. 243,961	15.4
Net	506,579	255,013	I. 251,566	98.6
Seven months—Jan. 1 to July 31:				
Cleve. & Canton.	214,973	201,538	I. 13.435	6.1
Net	65,385	48,483	I. 16,902	32.7
Leh. & Wilkesb.	5,478,211	4,595,753	I. 882,458	19.1
Net	991,539	570,133	I. 421,406	73 9
Pennsylvania Co.:				
N'west. Sys	9,735,630	10,100.320	D. 364,690	3.3
Net	2,819,066	3,463,388	D. 644,322	18.6
S'west. Sys.	7 439,259	7,822,255	D. 382,996	4.8
Net	1,306,427	2,045,877	D. 739,320	36.1
Stat. Isl. Rap. T.	514,196	478,016	I. 36 180	7.5
Net	143,364	106,517	I. 36,847	34.5

The following is the comparative statement of business for month of July of the Philadelphia & Reading Railroad, and the Philadelphia & Reading Coal & Iron Co.:

Railroad traffic:	1888.	1887.
Gross receipts	$1,848,131	$1,753,364
Expenses, excluding rentals and int. rest	884,847	837,981
	$963,284	$915,383
Other sources:		
Gross receipts	81,899	71.293
Gross expenses	71,562	51,194
	$10,337	$20,099
Total gross receipts of company	1,930,030	1,824,657
Total expenses R. R. Co., excluding rentals and interest	956,409	889,174
	$973,621	$935,483
The Philadelphia & Reading Coal & Iron Co.:		
Gross receipts	$2,303,752	$1.778.479
Gross expenses, excluding interest	2,196,479	1,640,672
	$107,272	$137,767
Total of both companies:		
Gross receipts	$4,233,782	$3,603,096
Gross expenses	3,152,889	2,529,846
Net earnings	$1,080,893	$1,073,250

The statement for July, 1888, as compared with the same month in 1887, shows:

An increase in gross earnings		
For the Railroad Co. of	$105,373	
For the Coal & Iron Co. of	525,313	
		$630,686
A increase in expenses		
For the Railroad Co. of	$67,235	
For the Coal & Iron Co. of	555,808	
		$623,043
A increase in net earnings of		7,643

The statement for the eight months ending July 31, 1888, as compared with the same period in 1887, shows:

A decrease in gross earnings of	$983.214
An increase in expenses of	514,988
A decrease in net earnings of	$1,498,202

The comparative statement of the gross earnings and operating expenses of the Northern Central for July, and the seven months to July 31, is as follows:

	1888.	1887.
Month of July:		
Gross earnings	$562,345	$536,336
Oper. expenses	345,496	346,955
Net earnings	$216,849	$189,381
Seven months to July 31:		
Gross earnings	$3,462.487	$3,617,929
Oper. expenses	2,746,619	2,173,712
Net earnings	$1,115,868	$1,444,217

Following is a statement of the New York, Lake Erie & Western for the month of July, and the ten months to July 31:

Month of July:	1888	1887	Inc. or Dec.
Gross earnings	$2,378,769	$2,330,285	I. $48,484
Oper. expenses	1,539,320	1,499.346	I. 39,974
	$839,449	$830,939	I. 8.510
Less due leased lines	208,825	199,085	I. 9.740
Net earnings	$630,624	$651,854	D. $1,230
Oct. 1 to July 31:			
Gross earnings	$22.398,433	$21.716,510	I. $681,923
Oper. expenses	14,601,173	13,990,656	I. 610,517
	$7,797,260	$7,725,854	I. $71,406
Less due leased lines	$1,965,075	$1,870,486	I. 94,590
Net earnings	$5,832,185	$5,855,368	D. $23,183

The statement of the Lake Shore & Michigan Southern for the quarter and half year ending June 30 shows:

Three months to June 30:	1888.	1887.	Inc. or Dec.
Gross earnings	$4,388,401	$4,443,860	D. $55,459
Oper. expenses	2,581,385	2,419,431	I. 161,954
Net earnings	$1,807.016	$2,024,429	D. $217,413
Other income	73,259	45,210	I. 28,049
Total	1,880 275	2,069.639	D. 189,364
Fixed charges	1.090,270	1,097,455	D. 7,185
Surplus	$790,005	$972,184	D. $182,179
Cash on hand	2,231,140	1,834,441	I. 396,699
Six months to June 30:	1888.	1887.	
Surplus over charges	$1,479,374	$1,766 578	
Sinking fund for 6 months	125,000	125.000	
Balance	$1.354,374	$1,641,578	
Dividend 2 per cent	989,330	989,330	
Surplus	$365.044	$652,248	
Earned on stock	2.7 per c.	3 3 per c.	

ANNUAL REPORTS.

The following is an index to the annual reports of railroad companies which have been reviewed in previous numbers of the current volume of the *Railroad Gazette:*